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Final
Site Management Plan
Fiscal Year 2008
Naval Station Norfolk
Norfolk, Virginia

NAVFAC
Naval Facilities Engineering Command
NAVFAC MID-ATLANTIC

Prepared for

Department of the Navy
Naval Facilities Engineering Command
Mid-Atlantic Division

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Prepared by

CH2MHILL

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Virginia Beach, Virginia

Contents

Tables (Tables are located at the end of each section.)

Figures (Figures are located at the end of each section.)

Acronyms and Abbreviations

Aip	Activity in process
AOCs	Areas of Concern
ARAR	applicable or relevant and appropriate requirements
AS	air sparge
asl	above sea level
AST	aboveground storage tank
BTAG	Biological Technical Assistance Group
CALF	Camp Allen Landfill
CASY	Camp Allen Salvage Yard
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act ("Superfund")
CHF	contaminant hazard factor
CI	Confirmatory Investigation
CS	confirmation study
DD	Decision Document
DDE	dichlorodiphenyldichloroethene
DoD	Department of Defense
DPVE	dual-phase vapor extraction
EE/CA	Engineering Evaluation and Cost Analysis
EP	Extraction Procedure
EPIC	EPA Photographic Interpretation Center
ER-M	effects range-medium
ESI	Expanded Site Investigation
FEMA	Federal Emergency Management Agency
FFA	Federal Facility Agreement
FFS	Focused Feasibility Study
FS	Feasibility Study
ft	foot/feet
FY	fiscal year
IAS	Initial Assessment Study
IDW	investigation-derived waste
in.	inches
IRA	Interim Remedial Action
IRP	Installation Restoration Program
IRPRI	IRP Remedial Investigation
IWMP	Industrial Wastewater Management Plan

LP	Lead Plating
LTM	long-term monitoring
LUC	land use control
µg/L	micrograms per liter
MCL	Maximum Contaminant Level
MIP	membrane interface probe
NAS	Naval Air Station
NAVFAC	Naval Facilities Engineering Command - Mid-Atlantic
NCP	National Contingency Plan
NFA	No Further Action
NFESC	Naval Facilities Engineering Support Center
NM	Naval Magazine
NPL	National Priorities List
NSN	Naval Station Norfolk
NTCRA	Non-time Critical Removal Action
O&M	operation and maintenance
OU	Operable Unit
O/WS	oil/water separator
PA/SI	Preliminary Assessment/Site Inspection
PCB	polychlorinated biphenyl
PRAP	Proposed Remedial Action Plan
PWC	Public Works Center
QADSY	Q-Area Drum Storage Yard
RA	Risk Assessment
RAB	Restoration Advisory Board
RAO	Remedial Action Objectives
RBC	risk-based concentrations
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RFA	RCRA Facility Assessment
RI	Remedial Investigation
RI/RA	Remedial Investigation/Risk Assessment
ROD	Record of Decision or Decision Document
RPO	Remedial Process Optimization
RRR	relative risk ranking
SC	specific conductivity
SI	Site Investigation
SMP	Site Management Plan
SSA	Site Screening Area
SSP	site screening process
SVE	soil vapor extraction
SVOC	semivolatile organic compound
SWMU	solid waste management unit

TAL	target analyte list
TCA	trichloroethane
TCE	trichloroethene
TBA	to be addressed
TCL	target compound list
TOC	total organic carbon
TOX	total organic halogen
TPH	total petroleum hydrocarbons
USEPA	United States Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VDEQ	Virginia Department of Environmental Quality
VHWMR	Virginia Hazardous Waste Management Regulations
VPDES	Virginia Pollutant Discharge Elimination System
VSWMR	Virginia Solid Waste Management Regulations
VOC	volatile organic compound
WDA	Waste Disposal Area
WWTP	wastewater treatment plant
yd^2	square yards
yd^3	cubic yards

SECTION 1

Introduction

This report presents the fiscal year (FY) 2008 Site Management Plan (SMP) for Naval Station Norfolk (NSN) located in Norfolk, Virginia. This report has been prepared by CH2M HILL for use by the Navy, United States (U.S.) Environmental Protection Agency (USEPA) Region III, the Virginia Department of Environmental Quality (VDEQ), and the NSN Restoration Advisory Board (RAB).

1.1 Purpose of the Site Management Plan

The purpose of the SMP is to provide a management tool for the Navy, USEPA, VDEQ, and Activity personnel for utilization in planning, scheduling, and setting priorities for environmental remedial response activities conducted at NSN. This SMP focuses on upcoming activities planned for FY 2008 and provides a projected schedule through FY 2012. NSN was proposed for inclusion on the National Priorities List (NPL) in the *Federal Register*, Volume 16, Number 117, on June 17, 1996 and was added to the NPL on April 1, 1997. NSN was included under the "Federal Facilities" section of the NPL in which federal agencies are considered responsible for conducting most of the response actions at facilities under their jurisdiction. A Federal Facility Agreement (FFA) between USEPA Region III and NSN was finalized in February 1999 (USEPA/Navy, 1999). Because NSN has a final FFA in place, the USEPA's role is less extensive than at NPL sites that do not have FFAs. However, the USEPA continues to function in an oversight role for the management and cleanup of the Installation Restoration Program (IRP) sites and solid waste management units (SWMUs) at NSN.

The SMP presents the rationale for the sequence of environmental investigations and remedial response activities to be completed for each site and the estimated schedule for completion of these activities. Detailed activity schedules are provided for FY 2008 and FY 2009, and prospective schedules are provided for FY 2010 through FY 2013.

1.2 Format of the Site Management Plan

This SMP consists of five sections.

- **Section 1—Introduction**, describes the SMP's scope and purpose; provides a description and history of NSN; summarizes the environmental setting and previous environmental investigations conducted at NSN; and provides the FFA site classification and supporting rationale for these determinations**.**
- **Section 2—Site Descriptions**, provides specific information regarding each of the active IRP sites. Site-specific information includes physical characteristics of the site, a description of past activities conducted at the site, and known contaminants in each site medium. A site map is provided for each site.

- **Section 3—Screening, Categorizing, and Prioritizing Sites,** describes the procedures for screening, categorizing and prioritizing sites based on the potential for human health and ecological risk. The system has been developed to establish priorities for cleanup actions, such that the "high" risk sites are addressed first.
- **Section 4—CERCLA Process Activities**, summarizes the processes of investigation, feasibility study, and remedial action (RA) for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) IRP sites. It also describes how team partnering has been applied to streamline the CERCLA process.
- **Section 5—Site Management Plan Schedules**, provides scheduling assumptions and SMP project schedules.

1.3 Facility Description

1.3.1 Facility Location/Physical Description

NSN, the largest naval base in the United States, is situated on 4,631 acres of land (A. T. Kearny, 1992) in the northwest portion of the City of Norfolk, Virginia. The location of NSN is shown in Figure 1-1. NSN is bounded on the north by Willoughby Bay, on the west by the confluence of the Elizabeth and James Rivers, and on the south and east by the City of Norfolk. A portion of NSN's eastern boundary is also formed by Mason Creek. NSN includes approximately 4,000 buildings, 20 piers, and an airfield. The western portion of NSN is a developed waterfront area containing the piers and facilities for loading, unloading, and servicing naval vessels. Land use in the surrounding area is commercial, industrial, and residential. The waterfront area south of NSN provides shipping facilities and a network of rail lines for several large industries. Residential and recreational areas border NSN at the base's southern, eastern, and northeastern boundaries.

Several other military installations are located within a 25 mile radius of NSN. These include Fort Monroe and Langley Air Force Base to the north, Naval Amphibious Base Little Creek and Fort Story to the east, Naval Air Station (NAS) Oceana to the southeast, Norfolk Naval Shipyard and St. Julien's Creek Annex to the south, and Naval Supply Center-Craney Island Fuel Terminal to the southwest.

1.3.2 Facility History and Mission

NSN began operations in 1917, when the U.S. Navy acquired 474 acres of land to develop a naval base to support World War I activities. Bulkheads were built along the coast to extend available land and after extensive dredge and fill operations, the total land under Navy control was 792 acres. An additional 143 acres of land were acquired in 1918 and officially commissioned as NAS Norfolk. Improvements to the piers and expansion of supply/ material handling facilities were also completed from 1936 through 1941.

During World War II major construction projects were completed, including a power plant, numerous runways and hangars, a tank farm, and several barracks/housing complexes. During this time, the area of NSN expanded to more than 2,100 acres. After World War II, NSN continued to acquire land through various types of land transfers and dredge and fill

operations conducted in areas of Mason Creek, the Bousch Creek Basins, and Willoughby Bay.

During its history, NSN has expanded to become the world's largest naval installation, with 105 ships homeported in Norfolk. The Base currently has 20 piers handling approximately 3,100 ship movements annually.

The mission of NSN is to provide fleet support and readiness for the U.S. Atlantic Fleet.

1.3.3 Operations/Process Descriptions

NSN operates in various capacities to provide support to vessels, aircraft, and other activities. NSN houses many tenants, each performing different operations involving the servicing and maintenance of vessels and aircraft.

The service and maintenance of ships includes utilities hook-up, onboard maintenance, and coordination of ship movements in the harbor. Additional functions include loading, unloading, and handling of fuels and oils used aboard the vessels. Ship and aircraft repair operations consist of paint stripping, patching, parts cleaning, repainting, engine overhauls, sandblasting, and metal-plating processes.

1.4 Environmental Setting

1.4.1 Topography and Surface Water Hydrology

Elevations at NSN range from sea level at the north and west boundaries to approximately 15 feet (ft) above sea level (asl) in central portions of the Base.

Four major surface water features surround the greater Norfolk area, including the James River, Elizabeth River, Willoughby Bay, and Chesapeake Bay, all of which are tidally influenced in this area.

The majority of surface water at NSN flows to either Mason Creek or the remnants of Bousch Creek. The main channel of Bousch Creek was filled during the development of NSN and replaced by a network of drainage ditches and underground culverts. Due to the proximity of tidal waters and the low relief of the land, both Mason Creek and the remnant tributaries of Bousch Creek are tidally influenced throughout NSN. Both creeks discharge to Willoughby Bay, and ultimately, to the Chesapeake Bay. In addition, some surface water runoff from NSN discharges directly to the Elizabeth River.

A Federal Emergency Management Agency (FEMA) flood insurance study established that the 100-year floodplain elevation at NSN is 8.5 ft asl (A. T. Kearny, 1992). Therefore, the portions of NSN adjacent to Willoughby Bay and the Elizabeth River are within the 100-year floodplain.

1.4.2 Geology and Hydrogeology

NSN is in the outer Atlantic Coastal Plain Physiographic Province, which is characterized by low elevations and gently sloping relief. The Base is underlain by more than 2,000 ft of gently dipping sandy sediment, ranging in age from Recent to Lower Cretaceous. Table 1-1

contains a stratigraphic column of hydrogeologic units of southeast Virginia (Harsh and Laczniak, 1990).

The uppermost geologic unit is the Columbia Group, composed of the Sand Bridge Formation and the underlying Norfolk Formation. The Columbia Group is approximately 60 ft thick. The upper 20 to 40 ft consist of unconsolidated fine sands and silts of low to moderate permeability. The lower 20 to 40 ft consist of relatively impermeable silt, clay, and sandy clay. The Yorktown Formation underlies the Columbia Group and is approximately 90 to 100 ft thick in the vicinity of the Base. It consists of moderately consolidated coarse sand and gravel with abundant shell fragments.

The two significant aquifer systems in the area are the water-table aquifer in the upper 20 to 40 ft of the Columbia Group and the underlying Yorktown Aquifer. The water-table aquifer is thin and consists of discontinuous heterogeneous sand and shell lenses. The depth to the water table is usually less than 8 ft. The Yorktown Aquifer is semi-confined beneath a clay layer in the upper Yorktown Formation. Water-bearing zones in the Yorktown Aquifer consist of fine to coarse sand, gravel, and shells.

1.5 Environmental History

1.5.1 Installation Restoration Program

NSN was proposed for inclusion on the NPL on June 17, 1996 and was added to the NPL on April 1, 1997. Because NSN is on the NPL, the Navy and USEPA approval of all Records of Decision (RODs) with state concurrence is required. Prior to delisting, no further action (NFA) RODs will be signed to formally document site close-out through the CERCLA process.

In 1975, the Department of Defense (DoD) began a program to assess past hazardous and toxic materials storage and disposal activities at military installations. The goals of this program, now known as the IRP, were to identify environmental contamination resulting from past hazardous materials management practices, to assess the impacts of the contamination on public health and the environment, and to provide corrective measures as required to mitigate adverse impacts.

The environmental condition of NSN is being investigated through the DoD's IRP. The IRP is being conducted in accordance with applicable federal and state environmental regulations and requirements.

In 1976, the Resource Conservation and Recovery Act (RCRA) was passed by Congress to address potentially adverse human health and environmental impacts of hazardous waste management and disposal practices. RCRA was legislated to manage the present and future disposal of hazardous wastes. In 1980, CERCLA, or "Superfund," was passed to investigate and remediate areas resulting from past hazardous waste management practices. This program is administered by USEPA or state agencies.

DoD's IRP was reissued in 1981, with additional responsibilities and authorities specified in CERCLA delegated to the Secretary of Defense. The Navy subsequently restructured the IRP to match the terminology and structure of the USEPA CERCLA Program. The current

IRP is consistent with CERCLA and applicable state environmental laws. The CERCLA process is further discussed in Section 4 of this SMP.

Team partnering was introduced to NSN in October 1996, to streamline the cleanup of former disposal sites by using consensus-based site management strategies during the CERCLA process. The partnering team (the Team) consists of Naval Facilities Engineering Command (NAVFAC), Mid-Atlantic, USEPA Region III, VDEQ, CH2M HILL, and other Navy contractors. The Team has streamlined the site investigation and remediation process to reduce costs and expedite cleanup and closure at IRP sites. Section 4 of this SMP discusses how team partnering has been applied within the CERCLA process in detail.

1.5.2 Previous Investigations

Basewide Investigations

Previous basewide investigations completed through the IRP include the Initial Assessment Study (IAS) (Environmental Science & Engineering, Inc., 1983); the IRP Remedial Investigation Interim Report (IRPRI) (Malcolm Pirnie, 1988); a RCRA Facility Assessment (RFA) (A. T. Kearney, 1992); an Aerial Photographic Site Analysis (USEPA, 1994); Phase I Relative Risk Ranking System Data Collection Sampling and Analysis Report (RRR—Phase I) (Baker, 1996a); and a Relative Risk Ranking System Data Collection Sampling and Analysis Report Phase II (RRR—Phase II) (Baker, 1996b).

1.5.3 Site Classification

Installation Restoration Program Sites

The purpose of the 1983 IAS was to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials handling and operations activities. Eighteen potentially contaminated sites were identified based on information obtained from historical records, photographs, site inspections, and personnel interviews. Several of the IAS sites also have separate designations under the RFA. The 18 IAS sites and RFA designations are:

- **Site 1—**Camp Allen Landfill (CALF)
- **Site 2—**Naval Magazine (NM) Area Slag Pile
- **Site 3—**Q-Area Drum Storage Yard
- **Site 4—**Transformer Storage Area P-71 (RFA M-5)
- **Site 5—**Pesticide Disposal Site
- **Site 6—**CD Landfill
- **Site 7—**Inert Chemical Landfill (RFA L-3)
- **Site 8—**Asbestos Landfill (RFA L-4)
- **Site 9—**Q-Area Landfill (RFA L-5)
- **Site 10—**Apollo Disposal Site (RFA M-23)
- **Site 11—**Repair Shop Drains
- **Site 12—**Alleged Mercury Disposal Site (RFA M-35)
- **Site 13—**Past Wastewater Outfalls (RFA TP-10/M-45)
- **Site 14—**Oil Spill-Piers 4, 5, and 7 (RFA M-24)
- **Site 15—**Oil Spill-Piers 20, 21, and 22

- **Site 16—**Fire, Building X-136
- **Site 17—**Fire, Building SDA-215 (RFA C-25/Area of Concern [AOC] E)
- **Site 18—**Former NM Waste Storage (RFA M-26)

Each of the 18 sites was evaluated for the past history of potential releases, potential migration pathways, and pollutant receptors. Sampling and analysis activities were not performed as part of the IAS. The IAS concluded that 6 of the 18 sites posed sufficient threats to human health or the environment to warrant further evaluation in a Confirmation Study (CS).

CSs were performed for the six sites recommended for further investigation in the IAS (Sites 1 through 6) to confirm or refute the existence of the suspected contamination. This effort for five of the six sites was documented in the 1988 IRPRI Report. An independent CS was performed by the Navy on Site 6-CD Landfill. The objectives of the CSs were to determine the extent of contamination, develop and evaluate economically feasible remedial alternatives, and recommend a remedial action.

Since the IAS, the Navy has identified five sites (Sites 19 through 23) through historical information that were added to the IRP:

- **Site 19—**Buildings V60/V90 (RFA M-34)
- **Site 20—**LP-20 Site
- **Site 21—**Building W-316 (RFA M-9/M-10)
- **Site 22—**Camp Allen Salvage Yard (CASY) (RFA C-14)
- **Site 23—**Building LP-20 Plating Shop (RFA M-29)

Close-out reports documenting the NFA determination for eight of the IRP Sites (IR Sites 7, 8, 9, 10, 12, 16, 17, and 18) were prepared and approved by the NSN Partnering Team as part of a "Consensus Agreement" for reference in the FFA. In fall 2000, the NSN Partnering Team revisited these sites to evaluate if the NFA determination was based on unrestricted use. For IR Sites 7, 8, 10, 12, 16, 17, and 18, soil-contaminant levels were initially compared only to industrial risk-based concentrations (RBCs). A reevaluation of the sites was performed that compared soil contaminant levels to residential RBCs. The results recommended four of the sites (7, 8, 12, and 17) for NFA and a Close-out Report was prepared and signed by the Tier I Partnering Team in March 2001 (CH2M HILL, 2001).

As indicated above, Site 9 (Q-Area Landfill) was closed out as NFA, however, the SWMU 14 accumulation pad is within the landfill boundary, and is undergoing investigation and remedial option evaluations as part of the Remedial Investigation/Feasibility Study (RI/FS) process. As a result of the SWMU 14 RI, samples have been collected within the Site 9 boundaries.

Sites 10, 16, and 18 were recommended for additional investigations and the fieldwork was completed in June 2001. As a result of the investigations, Close-out reports for Sites 10 and 16 were completed in January 2002 and May 2002, respectively (CH2M HILL, 2002a, b). Further investigations were completed at Site 18 in February and December of 2002 and an Expanded Site Investigation (ESI) Report (CH2M HILL, 2004b) has been submitted to the Tier I Partnering Team. Supplemental investigation activities were conducted in December of 2004 and June of 2006 to further evaluate a potential groundwater hotspot. Currently, an Engineering Evaluation and Cost Analysis (EE/CA), as part of the Non-time Critical Removal Action (NTCRA), is being generated. The purpose of the NTCRA is to eliminate

exposure of receptors to potential risk associated with groundwater at Site 18 and to prepare the site for close-out under CERCLA with NFA.

IRP Sites 13, 14, and 15 were recommended for NFA under CERCLA in the FFA as these sites are being addressed under the jurisdiction of other environmental programs (underground storage tank [UST] or Virginia Pollutant Discharge Elimination System [VPDES]).

In accordance with the Close-out Procedures for NPL, an *Interim Remedial Action Completion Report* for IRP Site 22 has been prepared and is currently being reviewed by the Navy.

The status of the remaining IRP sites is summarized in Table 1-2. A base map of NSN, showing the locations of the IRP sites and their current status in the remedial process, is provided as Figure 1-2. As an indicator of the progress made in cleaning up sites, this figure can be compared to Figure 1-3, which shows the cleanup status of these sites in March 1997.

Solid Waste Management Units

In March 1992, a RFA was completed for NSN. This study was a basewide inventory of existing SWMUs and other AOCs. A total of 274 SWMUs and 10 AOCs were tentatively identified in this study. The September 1994 USEPA Photographic Interpretation Center (EPIC) study of aerial photography identified 37 potential waste disposal areas (WDAs). Of the sites identified by the RFA and EPIC studies, 148 were identified as potentially contaminated. The RRR—Phase I report provided sampling results for 45 of the 148 identified sites. Of the sites sampled as part of the RRR—Phase I report, the Navy identified 25 for additional evaluation and possible investigation; these 25 sites were identified as SWMUs in the FY1996 SMP. The following lists the 25 SWMUs and their corresponding RFA/EPIC study identification:

- **SWMU 1—**SP-2B Accumulation Area (RFA C-83)
- **SWMU 2—**Building Z-309 Ash Hopper Storage Area (RFA M-13/M-14)
- **SWMU 3—**Building Z-309 Oil/Lubricant Storage Area (RFA AOC B)
- **SWMU 4—**Public Works Center (PWC) Sandblast Area (RFA M-19/M-20, EPIC WDA-1)
- **SWMU 5—**LF-61 Waste Holding Tank (RFA M-36)
- **SWMU 6—**Building V-28 Waste Pit (RFA M-31)
- **SWMU 7—**LF-18 Aircraft Ramp (EPIC WDA-3)
- **SWMU 8—**Firefighting Training School (EPIC WDA-20)
- **SWMU 9—**LP-200/MAC Terminal (EPIC WDA- 28/29)
- **SWMU 10—**LP-200/MAC Terminal/East (EPIC WDA- 31/32/35)
- **SWMU 11—**Old Weapons Station Entrance (EPIC WDA 33/34)
- **SWMU 12—**Disposal Area Near NM-37 (EPIC WDA-36)
- **SWMU 13—**Disposal Area PWC Operations, Near NM-71 (EPIC WDA-37)

- **SWMU 14—**Q-50 Satellite Accumulation Area (RFA C-17)
- **SWMU 15—**W-130 Accumulation Area (RFA C-27)
- **SWMU 16—**NM-37 Accumulation Area (RFA C-54)
- **SWMU 26—**Old Mounds Northeast of NM-140/141 (EPIC WDA-21)
- **SWMU 27—**Mason Creek Embankment (EPIC WDA-30)
- **SWMU 28—**Probable Solid Waste Disposal South of CEP 201 (EPIC WDA-11)
- **SWMU 29—**Solid Waste Disposal Area/CD-3/CD-4 (EPIC WDA-12)
- **SWMU 30—**Sludge Fill Disposal Area/Marshy Area South of Runway (EPIC WDA-15/16/17)
- **SWMU 32—**Solid Waste Disposal Area CEP-160 Embankment (EPIC WDA-5)
- **SWMU 33—**Debris Piled at Seawall/Corner of Sustain Pier (EPIC WDA-6)
- **SWMU 34—**Solid Waste Disposal Area CEP-200 (EPIC WDA-7)
- **SWMU 35—**Solid Waste Disposal Area CEP-196/Resolute Embankment (EPIC WDA-8)

To provide additional site data, a Phase II RRR sampling event was conducted in September 1996 with the results documented in the *Relative Risk Ranking System Data Collection Sampling and Analysis Report, Phase II, Baker Environmental, dated December 9, 1996*. During FFA negotiations conducted in 1997 and 1998, the Navy/USEPA project management team, in consultation with the Naval Base Partnering Team, identified several of the 148 sites to be included as SWMUs in the FY 1997 SMP. These SWMUs (and corresponding RFA/EPIC study identification numbers) are:

- **SWMU 24—**Building LF-53 Trenches (RFA M-39)
- **SWMU 25—**Q-82/78 Former PWC Parking (EPIC WDA-2)
- **SWMU 36—**Stormwater Drainage System (RFA M-44)
- **SWMU 37—**Q-82/78 Former PWC Parking (EPIC WDA-2)
- **SWMU 38—**CD Area behind the Compost Yard (EPIC WDA-13)
- **SWMU 39—**Open Dump/Boundary of CALF (EPIC WDA-18/19)
- **SWMU 40—**MCA-603 Pits (EPIC WDA-22)
- **SWMU 41—**Disposal Area, CA-99 Golf Course (EPIC WDA-23)
- **SWMU 42—**CEP 201 Area (EPIC WDA-9)

Based upon the results of the two RRR studies, available historical operating data, and visual site inspections, the project management team recommended ten SWMUs (SWMUs 5, 7, 11, 13, 15, 24, 26, 27, 29, and 30) for NFA under CERCLA in the FFA.

Ongoing remediation is being conducted at SWMU 37, the Q-82/78 Former PWC Parking Area, in accordance with Virginia UST regulations. VDEQ is providing oversight of the site remediation. Therefore, the project management team reviewed information pertaining to

the Site Characterization and Corrective Action Plan and has determined that NFA under CERCLA was required at SWMU 37.

The NSN stormwater drainage system (SWMU 36, RFA M-44) has undergone a $10-million rehabilitation project. The inspection and assessment of the stormwater drainage system has been completed and the rehabilitation (repair/replacement) has been conducted. Therefore, the project management team determined that no further action under CERCLA is required.

A Confirmatory Investigation (CI) was conducted at SWMUs 1, 4, 6, and 8 in 1996. The CI results were documented in the *Draft Report for the Solid Waste Management Unit Confirmatory Investigation Report* (CH2M HILL, 1996). The investigation results identified lead contamination in the soil at SWMU 1 and a removal action was conducted there in October 1997. As a result of the removal, the project management team determined no further action under CERCLA is required. The CI results also indicated that additional characterization was needed at SWMUs 4, 6, and 8. However, the Navy removed SWMU 4 from the CERCLA program in May 2003 because the site remains active. Due to the lack of a complete pathway and release, SWMU 6 was recommended for NFA in the Close-out Report signed by the Tier I Partnering Team in November 2002 (CH2M HILL, 2002d). A re-evaluation of SWMU 8 was performed that compared groundwater and surface and subsurface soil to RBCs for residential and industrial soil, USEPA Region III tap water RBCs, and USEPA drinking water Maximum Contaminant Levels (MCLs) for groundwater. The results recommended SWMU 8 for NFA and a Close-out Report was prepared and signed in March 2001 (CH2M HILL, 2001).

A confirmatory Site Investigation (SI) was initiated in summer 1998 for SWMUs 9, 10, 12, 14, 16, 28, 32, 33, 34, 35, 38, 40, 41, and 42. The SI's objectives were to determine the extent of contamination at each SWMU, to develop and evaluate economically feasible remedial alternatives for remedial action at contaminated SWMUs, and to close out qualified sites.

A supplemental investigation was conducted in the fall of 2000 for SWMUs 12, 14, 16, 38, and 39. The study's objectives were to further characterize selected SWMUs. As a result of this investigation SWMUs 38 and 39 were closed out.

A RI was completed for SWMUs 12 and 16 in 2003. The objectives were to characterize extent and determine potential risks to human health and the environment. As a result of the RI, no action is required for SWMUs 12 and 16 and is documented in the final ROD signed in the Fall of 2005 (CH2M HILL, 2005a).

The current status of SWMUs under investigation at NSN is summarized in Table 1-3. A base map of NSN, showing the locations of the SWMU sites and their current status in the remedial process, is provided as Figure 1-4. As an indicator of the progress made in cleaning up SWMU sites, this figure can be compared to Figure 1-5, which shows the clean-up status of these sites in March 1997.

No Further Action Sites

The remaining 148 sites previously identified were individually evaluated during the NFA negotiations between the Navy and the USEPA. These sites were not previously discussed in the SMP. The project management team determined that NFA is required for the sites as detailed in Table 1-4.

FFA Site Screening Areas

Site Screening Areas (SSAs) are areas that either pose or may potentially pose a threat to public health, welfare, and the environment. SSAs may expand or contract in size during the site investigation as information becomes available indicating the extent of contamination and the area needing study. In the NSN FFA, four SSAs are identified:

- **SSA 1—**Q-72 Sandblast Area (SWMU 4; RFA M-19/M-20; EPIC WDA-1)
- **SSA 2—**V-28 Waste Pit (SWMU 6; RFA M-31)
- **SSA 3—**Fire Fighting School (SWMU 8; EPIC WDA-20),
- **SSA 4—**NM-37 Area (SWMU 12; EPIC WDA-36); (SWMU 16; RFA C-54)

Site investigations were completed during 1998 or 1999 at each SSA. The investigations at each area detected levels of site-related constituents above RBCs. A background investigation was completed to assess if the levels also exceeded background levels. To date, SSA 3 has been recommended for NFA and a Close-out Report has been completed. SSA 2 (V-28 Waste Pit) has also been recommended for NFA and a Close-out Report has been completed. SSA 1 (Q-72 Sandblast Area) is currently an active site; therefore, the NSN Partnering Team came to consensus that SSA 1 is NFA under CERCLA and the cleanup of this site will be addressed as part of the Military Construction Program when the sandblasting operations cease. SSA 4 has undergone the RI phase in which an RI report including a human health and ecological risk assessment were completed. The NSN Partnering Team has agreed that NFA is required and a ROD was completed in October 2005.

FFA Areas of Concern

The FFA signed by USEPA on February 18, 1999 listed eight AOCs as sites under evaluation to determine if the sites should proceed in the screening process and be investigated as SSAs, or whether the information under review supports a NFA determination. The documentation and sampling of each of these areas were discussed at the Tier I Partnering meeting on March 16, 1999. The current status of the eight AOCs are presented in Table 1-5.

TABLE 1-1
Stratigraphic and Hydrogeologic Units of Southeast Virginia
(from Harsh and Laczniak, 1990)

Geologic Age		Group	Stratigraphic Formation	Hydrogeologic Unit
Period	**Epoch**			
Quaternary	Holocene	Columbia	Holocene Deposits	Columbia aquifer
	Pleistocene		Undifferentiated Deposits	
Tertiary	Pliocene		Bacons Castle Formation	Yorktown confining unit
		Chesapeake	Yorktown Formation	Yorktown-Eastover aquifer
	Miocene		Eastover Formation	
			St. Mary's Formation	St. Mary's confining unit
			Choptank Formation	St. Mary's Choptank aquifer
			Calvert Formation	Calvert confining unit
	Oligocene	Pamunkey	Old Church Formation	Chickahominy-Piney Point aquifer
	Eocene		Chickahominy Formation	
			Piney Point Formation	
			Nanjemoy Formation	Nanjemoy-Marlboro Clay confining unit
	Paleocene		Marlboro clay	
			Aquia Formation	Aquia aquifer
			Brightseat Formation	Brightseat confining unit
				Brightseat aquifer
Cretaceous	Late Cretaceous		Undifferentiated Sediments	Upper Potomac confining unit
	Early Cretaceous		Potomac Formation	Upper Potomac aquifer
				Middle Potomac confining unit
				Middle Potomac aquifer
				Lower Potomac confining unit
				Lower Potomac aquifer

TABLE 1-2
Status Summary of IRP Sites, September 2007
Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/ DD	RD	RA Construct	RA Ops	Comments
CERCLA Investigation in Progress														
Site 18 - Former NM Hazardous Waste Storage Area	RFA M-26	1983	2002, 2003		2001, 2003, 2004, 2005									Final SI completed in November 2002. Final ESI completed in July 2004. Technical Memoranda for Supplemental investigations were completed in December 2004 and July 2006. EE/CA for groundwater interim action is currently being prepared.
Site 23 - Building LP-20 Plating Shop	RFA M-29		2005	2006	2004									This site has recently been transferred to the CERCLA program from RCRA. Final SI Work Plan completed in October 2004. Final SI report completed in April 2006. Final EE/CA completed December 2006. Construction for the interim action was implemented in June 2007.
Remedy in Place (Ongoing O&M and LTM)														
Site 1 - Camp Allen Landfill		1983*	1988*		1991	1994	1994	1995		1995	1996, 2005	1997		Removal action (soil) completed. Construction of Groundwater Pump and Treat as well as DPVE systems complete and in operation. Long-term monitoring to evaluate system effectiveness was initiated in 1999.
Site 2- NM Slag Pile - All Media		1983*	1988*		1996, 1998			1999		2000	1999, 2005	1999		ROD finalized in December 2000. Sediments removed in December 1999. Annual post closure monitoring instituted in October 2000.

TABLE 1-2
Status Summary of IRP Sites, September 2007
Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/ DD	RD	RA Construct	RA Ops	Comments
Site 3 - Q-Area Drum Storage Yard		1983*	1988*		1991	1996	1996	1996		1996	1996, 2005	1998		Construction of Air Sparge/SVE system complete and in operation. Long-term monitoring to evaluate the effectiveness of treatment system was instituted in 1999.
Site 6 - CD Landfill		1983*	1991		1993		1995							Removal of contaminated sediments partially completed in fall 1997. Cap construction completed in December 1999. Post closure monitoring initiated in January 2000.
Site 6, OU1 - Sediments								1996		1996	1996, 2005	1999		
Site 6, OU2 - Landfill Cap								1998		1999	1999, 2005	1999		
Site 20 - Building LP-20 Site	RFA M-9/M-10	1991	1991		1994	1996	1996	1996		1996	1997, 2005	1998		Construction of Air Sparge/SVE system to address TPH and chlorinated solvents in groundwater complete. Remediation systems are currently in operation. Long-term monitoring to evaluate effectiveness was instituted in 1999.
Site 22 - Camp Allen Salvage Yard	RFA C-14	1994	1994	1999, 2002	1996	1999	2002	2002		2004	2002, 2004	2002		An EE/CA was completed in January 2002 recommending that a soil cover be placed at the site. The cover was completed in Summer 2002. The ROD, addressing soil and sediment cleanup strategies, was finalized in September 2004. The RD for Land Use Controls was completed in December 2004.

TABLE 1-2
Status Summary of IRP Sites, September 2007
Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/ DD	RD	RA Construct	RA Ops	Comments
Response Complete/NFA														
Site 4 - P-71 Transformer Storage	RFA M-5	1983*	1988*		1991	1991	1991	1991		1992	1991	1992		Cleanup completed. Groundwater monitoring completed in 1995.
Site 5 - Pesticide Disposal Site		1983*	1988** 1998***	1998								1999		Pesticide-contaminated soil removal action completed in November 1999 and the site was closed out.
Site 7 - Inert Chemical Landfill	RFA L-3	1983							2001					Close-Out report completed in March 2001
Site 8 - Asbestos Landfill	RFA L-4	1983							2001					Close-Out report completed in March 2001
Site 9 Q-50 Area Landfill	RFA L-5	1983							2001					Close-Out report completed; Site revisited in 2002 for to determine if NFA was for unrestricted use; SWMU 14 RI currently in progress which has included collection of soil data from Site 9
Site 10 - Apollo Fuel Disposal Sites	RFA M-23	1983	2001		2001				2002					Close-Out report completed in January 2002
Site 12 - Alleged Mercury Disposal Site	RFA M-35	1983							2001					Close-Out report completed in March 2001
Site 16 - Chemical Fire Building X-136		1983	2001		2001				2002					Close-Out report completed in May 2002
Site 17 - Chemical Fire Building SDA-215	RFA C-25/AOC E	1983							2001					Close-Out report completed in March 2001

TABLE 1-2
Status Summary of IRP Sites, September 2007
Naval Station Norfolk

Site	RFA Designations	PA or IAS	SI or CS	EE/CA	Work Plans	RI	FS	PRAP	Close-Out Report	ROD/ DD	RD	RA Construct	RA Ops	Comments
Site 19 - Buildings V-60/V-90	RFA M-34	1988	1988		1989	1989	1989	1989		1989	1989	1991		Building demolition and site cleanup completed.
Site 21 - Building W-316	RFA M-9/10	1996	1996	1997	1996									PCB-contaminated soil removal action completed in March 1998 under TSCA.

Legend:

993	Year Activity Completed (fiscal year)	RI	Remedial Investigation	LTM	Long-Term Monitoring
X	Activity Completed (date unknown)	FS	Feasibility Study	Construct	Construction Phase
Aip	Activity In Progress (expected completion)	PRAP	Proposed Remedial Action Plan	Ops	Operations Phase
^	Activity Planned	ROD	Record of Decision or Decision Document	*Refers to "Initial Assessment Study of Sewells Point	
PA	Preliminary Assessment	RD	Remedial Design	Naval Complex," dated February 1983.	
IAS	Initial Assessment Study	RA	Remedial Action /Removal Action	** Refers to "Installation Restoration Program	
SI	Site Investigation	TBA	To Be Addressed	Investigation	
CS	Confirmation Study	NFA	No Further Action	Interim Report," dated March 1988.	
EE/CA	Engineering Evaluation/Cost Analysis	DD	Decision Document	***CH2M HILL SI completed February 1998	

TABLE 1-3
Status Summary of SWMUs, September 2007
Naval Station Norfolk

	SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/SI(n)	SI/CI/ SSI***	RI/FS	EE/CA	Close-Out Report	ROD/ DD	RD	RA Construction	Comments
CERCLA Investigation in Progress														
14	Q-50 Satellite Accumulation Area	RFA C-17	1996	1996	1998	1998		2004						Final RI/HHRA/ERA completed in August, 2004. EE/CA for soil action currently being prepared.
Response Complete/NFA														
1	SP-2B Accumulation Area	RFA C-83	1996	1996			1996							Lead removal in October 1997 and determined no further action under CERCLA
2	Building Z-309 Ash Hopper Storage Area	RFA M-13/ M-14	1996	1996						2000				Close-Out Report was completed in March, 2000 based on RRR report
3	Building Z-309 Oil/Lubricant Storage Area	RFA AOC B	1996	1996						2000				Close-Out Report was completed in March, 2000 based on RRR report
4	PWC Sandblast Area	RFA M-19/M-20; EPIC WDA-1	1996	1996	1996	1996								Site removed from the CERCLA program because the facility remains active
5	LF-61 Waste Holding Tank	RFA M-36	1996	1996										No further action based on RRR report
6	Building V-28 Waste Pit	RFA M-31	1996		1996, 2001	1996	1998, 1999			2002				Close-Out Report was completed in November, 2002 based on results of CI report
7	LF-18 Aircraft Ramp	EPIC WDA-3	1996	1996										No further action based on RRR report
8	Fire Fighting School	EPIC WDA-20	1996		1996	1996	1999			2001				Close-Out Report was completed in March, 2001

TABLE 1-3
Status Summary of SWMUs, September 2007
Naval Station Norfolk

	SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/SI(n)	SI/CI/ SSI***	RI/FS	EE/CA	Close-Out Report	ROD/ DD	RD	RA Construction	Comments
9	LP-200/MAC Terminal	EPIC WDA-28/29	1996		1998	1998				2001				Close-Out Report was completed in October, 2001
10	LP-200/MAC Terminal/East	EPIC WDA-31/32/35	1996	1996	1998	1998				2001				Close-Out Report completed in October, 2001
11	Old Weapons Station Entrance	EPIC WDA-33/34	1996	1996										No further action based on RRR report
12	Disposal Area Near NM-37	EPIC WDA-36	1996	1996	1998	1998		2004			2005			Final RI completed in July, 2004. Final ROD completed in October 2005. No further action.
13	Disposal Area PWC Operations, Near NM-71	EPIC WDA-37	1996	1996										No further action based on RRR report
15	W-130 Accumulation Area	RFA C-27	1996	1996										No further action based on RRR report
16	NM 37 Accumulation Area	RFA C-54	1996	1996	1998	1998		2004			2005			Final RI completed in July, 2004. Final ROD completed in October 2005. No further action.
17	Surface Disposal Area; Waste Generated from SP-10 Maintenance		1996	1996										No further action based on RRR report
18	Surface Disposal Area; Waste Generated from V-88 Lab		1996	1996										No further action based on RRR report
19	Surface Disposal Area; Waster Generated from LF-53 Painting		1996	1996										No further action based on RRR report

TABLE 1-3
Status Summary of SWMUs, September 2007
Naval Station Norfolk

	SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/SI(n)	SI/CI/ SSI***	RI/FS	EE/CA	Close-Out Report	ROD/ DD	RD	RA Construction	Comments
20	Surface Disposal Area; Waste Generated from Aircraft Maintenance, Former UST Site		1996	1996										No further action based on RRR report
22	Surface Disposal Area; Waste Generated from Bldg. LF-60 Helicopter Maintenance		1996	1996										No further action based on RRR report
24	Building LF-53 Trenches	RFA M-39	1996	1996										No further action based on RRR report
25	Q-82/78 Former PWC Parking Lot		1996	1996										No further action based on RRR report
26	Old Mounds Northeast of NM-140/141	EPIC WDA-21	1996	1996										No further action based on RRR report
27	Mason Creek Embankment	EPIC WDA-30	1996	1996										No further action based on RRR report
28	Probable Solid Waste Disposal South of CEP 201	EPIC WDA-11	1996		1998	1998				2000				Streamlined Risk Assessment/Close-Out Report was submitted May, 2000.
29	Solid Waste Disposal Area/CD-3/CD-4	EPIC WDA-12	1996	1996										No further action based on RRR report
30	Sludge Fill Disposal Area/Marshy Area South of Runway	EPIC WDA-15/16/17	1996	1996										No further action based on RRR report
31	Solid Waste Disposal; Area V-82		1996	1996										No further action based on RRR report

TABLE 1-3
Status Summary of SWMUs, September 2007
Naval Station Norfolk

	SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/SI(n)	SI/CI/ SSI***	RI/FS	EE/CA	Close-Out Report	ROD/ DD	RD	RA Construction	Comments
32	Solid Waste Disposal Area CEP 160/161 Embankment	EPIC WDA-5	1996		1998	1998				2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
33	Debris Piled at Seawell	EPIC WDA-6	1996		1998	1998				2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
34	Solid Waste Disposal Area CEP 200	EPIC WDA-7	1996		1998	1998				2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
35	Solid Waste Disposal Are CEP 196/Resolute Embankment	EPIC WDA-8	1996		1998	1998				2000				Streamlined Risk Assessment/Close-Out report was submitted in May 2000.
36	Stormwater Drainage System	RFA M-44												No further action under CERCLA; undergoing a $10 million rehabilitation project
37	Q-82/78 Former PWC Parking Lot	EPIC WDA-2	1996	1996										No further action under CERCLA; moved out of CERCLA in 1998 and into the UST Program.
38	CD Area Behind Compost Yard	EPC WDA-13		1996	1998	1998	2000			2001				Close-Out Report was completed in March, 2001
39	Open Dump & Disposal Area near boundary of Camp Allen Landfill	EPIC WDA-18/19					2000			2001				Close-Out Report was completed in March, 2001

TABLE 1-3
Status Summary of SWMUs, September 2007
Naval Station Norfolk

	SWMU	RFA Designations	Phase 1 RRR*	Phase 2 RRR**	Work Plans	PA/SI(n)	SI/CI/ SSI***	RI/FS	EE/CA	Close-Out Report	ROD/ DD	RD	RA Construction	Comments
40	MCA-603 Pits	EPIC WDA-22			1998	1998				2000				Close-Out Report was completed in May, 2000
41	Disposal Area,CA-99 Golf Course	EPIC WDA-23			1998	1998				2000				Close-Out Report was completed in May, 2000
42	CEP 201 Area	EPIC WDA-9	1996	1996	1998	1998				2000				Close-Out Report was completed in May, 2000
Sites where Information not available														
21														
23														

Legend:

1993	Year Activity Completed (fiscal year)
X	Activity Completed (date unknown)
Aip	Activity in Progress (expected completion)
^	Activity Planned
PA	Preliminary Assessment
IAS	Initial Assessment Study
SI(n)	Site Inspection
CS	Confirmation Study
EE/CA	Engineering Evaluation/Cost Analysis
RI	Remedial Investigation
FS	Feasibility Study
PRAP	Proposed Remedial Action Plan
ROD	Record of Decision or Decision Document
RD	Remedial Design
RA	Remedial Action /Removal Action
TBA	To Be Addressed
NFA	No Further Action
DD	Decision Document
SI	Site Investigation
Construct	Construction Phase
Ops	Operations Phase

*Refers to "Initial Assessment Study of Sewells Point Naval Complex," dated February 1983.

** Refers to "Installation Restoration Program Investigation Interim Report," dated March 1988.

***CH2M HILL SI completed February 1998

TABLE 1-4
Additional NFA Sites, September 2007
Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA AOC C	Building V-93-1	UST / AST; Removed
RFA AOC C	Building V-93-2	UST / AST; Removed
RFA AOC C	Building V-93-3	UST / AST; Removed
RFA AOC C	Building V-112-1	UST / AST; Removed
RFA AOC C	Building V-112-2	UST / AST; Removed
RFA AOC C	Building V-112-3	UST / AST; Removed
RFA AOC C	Building NM-71-A	UST / AST; Removed
RFA AOC C	Building NM-71-B	UST / AST; Removed
RFA AOC C	Building U-117	UST / AST; Removed
RFA AOC C	Building CA-501-1	UST / AST; Removed
RFA C-4	Building CA-483 (A) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-5	Building CA-483 (B) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-6	Building CA-483 (C) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-7	Building CA-483 (D) SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-9	Building W-7 (Pier 7) SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-18	Building Z-309 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-26	Building CA-501 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-27	Building W-130 SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-33	Building V-88 SAA (SWMU 18)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-36	Building LF-53 SAA (SWMU 19)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-61	Building LP-20 SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-71	Building SP-10 SSA (SWMU 17)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-79	LP Fuel Farm SAA	Team site visit, review of existing documentation and review of operational procedures
RFA C-80	Building LP-100 SAA (SWMU 20)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-81	Building LF-59 SAA	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA C-82	Building LF-60 SAA (SWMU 22)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-18	Sanitary Sewers	Team site visit, review of existing documentation and review of operational procedures
RFA M-22	Sewage Waste Oil Barges	Team site visit, review of existing documentation and review of operational procedures
RFA M-36	Building LF-61 Waste Tank Area (SWMU 5)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-39	Building LF-53 Trenchs (SWMU 24)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
RFA M-46	P-1 Pond	Team site visit, review of existing documentation and review of operational procedures
RFA R-3	LF-68 Former Hazardous Waste Storage Area	Team site visit, review of existing documentation and review of operational procedures
RFA O-1	A-80 Building O/WS	Oil / Water Separator; Managed under IWMP
RFA O-2	A-81 Building O/WS	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-3	A-127 Building	Oil / Water Separator; Managed under IWMP
RFA O-4	A-Area	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-7	CEP-188 Building	Oil / Water Separator; Managed under IWMP
RFA O-8	LF-38 Building	Oil / Water Separator; Demolition Complete
RFA O-9	LF-53 Building	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants

TABLE 1-4
Additional NFA Sites, September 2007
Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA O-10	LF-59 Building	Oil / Water Separator; Managed under IWMP
RFA O-11	LF-60 Building	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-23	LP-20 Building	Oil / Water Separator; Managed under IWMP
RFA O-24	LP-22 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-25	LP-32 Building	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-27	LP-48 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-30	LP-78 Building	Oil / Water Separator; Demolition Complete - FY97
RFA O-31	LP-167 Area 1	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-32	LP-167 Area 2	Oil / Water Separator; Managed under IWMP
RFA O-33	LP-167 Area 3	Oil / Water Separator; Managed under IWMP
RFA O-34	LP-167 Area 4	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-35	LP-167 Area 5	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-36	LP-167 Area 6	Oil / Water Separator; Managed under IWMP
RFA O-37	LP-176 Building	Oil / Water Separator; Demolition Complete - FY98
RFA O-43	SP-38 Building	Oil / Water Separator; Managed under IWMP
RFA O-45	SP-296 Hanger	Oil / Water Separator; Managed under IWMP
RFA O-46	SP-313	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-50	V-15 Building	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-51	V-27 Area 1	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-52	V-28 Area 2	Oil / Water Separator; Inactive due to BRAC closure of NSN tenants
RFA O-55	V-49 S Area 5	Oil / Water Separator; Managed under IWMP
RFA O-56	V-49 W Area 6	Oil / Water Separator; Managed under IWMP
RFA O-57	V-146 Building	Oil / Water Separator; Demolition Complete - FY97
RFA O-59	W-6 Building	Oil / Water Separator; Managed under IWMP
RFA O-60	Fire Fighting School	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
RFA O-61	Fire Fighting School	Oil / Water Separator; Demolition Complete - FY92
RFA O-62	Fire Fighting School	Oil / Water Separator; Demolition Complete - FY92
RFA T-3	Wastewater Tank 3 Building CEP-200	UST / AST; Regulated under VDEQ
RFA T-10	W-7 Building	UST / AST; Regulated under VDEQ
RFA T-12	W-388 Building high flashpoint tank	UST / AST; Regulated under VDEQ
RFA T-13	W-388	Oil / Water Separator; Managed under IWMP
RFA T-14	A-81 Building	UST / AST; Removed
RFA T-15	A-81 Building Tank No.1	UST / AST; Removed
RFA T-16	A-81 Building Tank No.2	UST / AST; Removed
RFA T-17	Fire Fighting School	UST / AST; Removed
RFA T-20	CEP-188 Building	UST / AST; Removed
RFA T-21	V-49 Building	UST / AST; Removed
RFA T-22	U-132 calibration fluid	UST / AST; Removed
RFA T-23	U-132 varsol	UST / AST; Removed

TABLE 1-4
Additional NFA Sites, September 2007
Naval Station Norfolk

Site	Site Description	Reason for No Further Action
RFA T-24	U-132 waste oil	UST / AST; Removed
RFA T-26	NH-34 Building	UST / AST; Removed
RFA T-27	NH-35 Building	UST / AST; Removed
RFA T-28	NH-94-1W Building	UST / AST; Regulated under VDEQ
RFA T-29	NH-94-2W Building	UST / AST; Regulated under VDEQ
RFA T-30	MCE-225-4 Building	UST / AST; Removed
RFA T-31	MCE-57-1	Oil / Water Separator; Demolition Complete - FY97
RFA T-32	W-6-1	UST / AST; Removed
RFA T-33	W-6-2	UST / AST; Removed
RFA T-34	W-6-3	UST / AST; Removed
RFA T-35	W-6-4	UST / AST; Removed
RFA T-36	W-196 Building	UST / AST; Removed
RFA T-37	LAFB Buildng	UST / AST; Removed
RFA T-38	NM-59 Bulding	UST / AST; Removed
RFA TP-6	Fire Fighting School Wastewater Pit	Oil / Water Separator; Demolition Complete - FY99
RFA W-4	Q-50	Oil / Water Separator; Documentation of integrity and functionality inspections on file with the EPA Region III
EPIC WDA-3	Building LF-18 Aircraft Ramp (SWMU 7)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-4	Building V-82 Area (SWMU31)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-12	Building CD-2/CD-3	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-14	Building U-40	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-15/16/17	Marshy Area south of runway (SWMU 30)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-21	Northeast of Building NH-140/141 (SWMU 26)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-24	Building LP-3	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-25	Building SP-367	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-26	Building SP-86	Team site visit, review of existing documentation and review of operational procedures
EPIC WDA-27	Building SP-85 Area	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-30	Mason Creek Embankment (SWMU 27)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-33/34	NM-43 Old Weapons Station Entrance (SWMU 11)	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data
EPIC WDA-37	Building NM-71	Team site visit, review of existing documentation and review of operational procedures, review of RRR Analytical Data

Notes:
AST - Aboveground Storage Tank.
BRAC - Base Realignment and Closure.
SAA - Satellite Accumulation Areas are container storage areas used to manage various types of wastes generated from operations in the building.
SSA - Site Screening Areas are areas that either pose or may potentially pose a threat to public health, welfare, and the environment.
IWMP - NSN Industrial Wastewater Management Plan.
O/ WS - Oil/ Water Separator

TABLE 1-5
Status Summary of FFA Areas of Concern, September 2007
Naval Station Norfolk

AOC Designation	Site Description		Evaluation Determination
AOC 1	Building Z-309 Area	SWMU 2; RFA M-13/14	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 3; RFA AOC B	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unresricted
AOC 2	MAC Area	SWMU 9; EPIC WDA-28/29	In October 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 10; EPIC WDA-31/32/35	In October 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
AOC 3	CEP 201 Area	SWMU 42; EPIC WDA-9/10	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unresricted
	CEP Area	SWMU 28; EPIC WDA-11	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 32; EPIC WDA-5	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 33; EPIC WDA-6	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 34; EPIC WDA-7	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
		SWMU 35; EPIC WDA-8	In May 2000, Streamline Risk Assessment Approved, No Further Action is Required and the Land Use will be Unresricted
AOC 4	Q-50 PWC Accumulation Area	SWMU 14; RFA C-17	*Refer to Table 1-2 for status*
AOC 5	CD Area Behind the Compost Yard	SWMU 38; WPIC WDA-13	In March 2001, Close-Out Report Signed, No Further Action is Required and the Land Use will be Unresricted
AOC 6	Open Dump and Disposal Area at Boundary of Camp Allen Landfill	SWMU 39; EPIC WDA-18/19	In March 2001, Close-Out Report Signed, No Further Action is Required and the Land Use will be Unresricted
AOC 7	MCA-603 Pits	SWMU 40; EPIC WDA-22	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unresricted
AOC 8	CA-99 Golf Course Disposal Area	SWMU 41; EPIC WDA-23	In March 2000, Close-Out Report Approved, No Further Action is Required and the Land Use will be Unresricted

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N

0 2000 4000 Feet

Figure 1-1
Installation Location Map
Naval Station Norfolk

CH2MHILL

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LEGEND

- NFA Sites Per FFA Close-out Reports
- Remedial/Removal Action Complete
- Remedial/Removal Action in Progress
- Remedial/Site Investigation in Progress
- Groundwater Source Area
- Deep Aquifer Groundwater Plume
- Shallow Aquifer Groundwater Plume

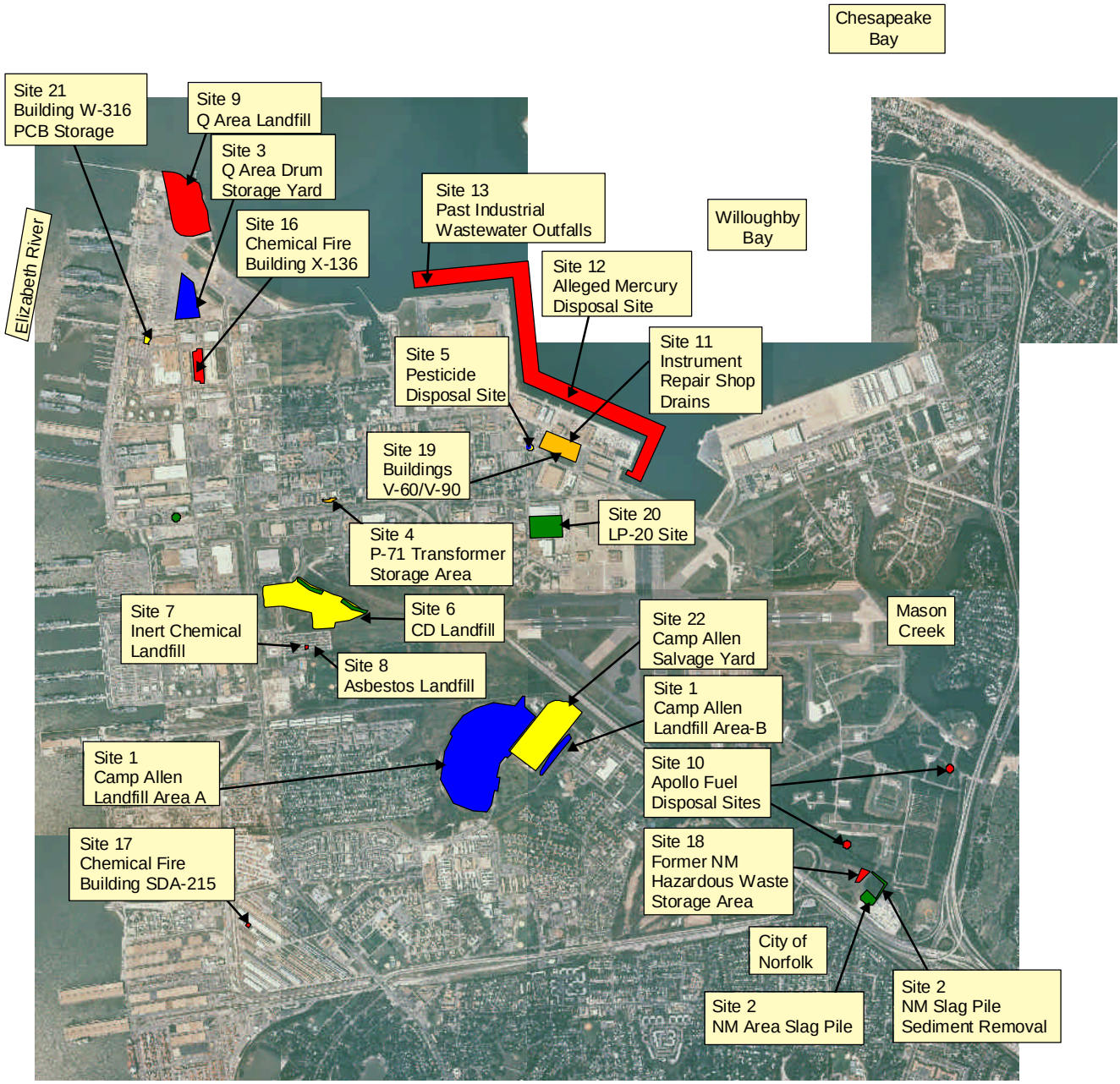
N

0 1500 3000 Feet

Figure 1-2
Base Map with IRP Site Locations
and Current Clean-up Status
October 2007
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

File Path: v:\18gis\nsn\figures\153013.apr



LEGEND

- NFA Sites Per IAS Recommendation
- Remedial /Removal Action Complete
- Remedial/Removal Action in Progress
- Remedial/Site Investigation in Progress
- Remedial Design in Progress

N

0 1650 3300 Feet

Figure 1-3
IRP Site Clean-Up Status
As of March 1997
Naval Station Norfolk

CH2MHILL

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LEGEND

- NFA Sites Per FFA Close-out Reports
- Remedial/Removal Action Complete
- Remedial/Site Investigation in Progress
- Transferred from CERCLA Program

N

0 1600 3200 Feet

Figure 1-4
Base Map
Additional SWMU Locations
and Current Clean-up Status
September 2007
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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LEGEND

- Remedial/Removal Action Complete
- Remedial/Removal Action In Progress
- Remedial/Site Investigation In Progress
- To Be Determined

N

0 1800 3600 Feet

Figure 1-5
Additional SWMU Clean-Up Status
As of March 1997
Naval Station Norfolk

CH2MHILL

SECTION 2

Site Descriptions

This section provides specific information regarding the IRP sites and SWMUs at NSN that are currently undergoing remediation or investigation. Site-specific information includes site physical characteristics, a description of past activities conducted at the site, and known contaminants in each site medium. In addition, the current status of each site in the IRP is briefly discussed. A site map is provided for the IRP sites and SWMUs. However, inactive sites that were either closed out through a consensus agreement or recommended for NFA are not discussed in this section.

2.1 Installation Restoration Program Sites

The following eight IRP site descriptions include physical characteristics, past activities, detected contaminants, and future remediation plans for each site, if known.

2.1.1 Site 1—Camp Allen Landfill

The CALF site includes two distinct areas (Area A, the 45-acre landfill, and Area B, the 2-acre fire disposal area), as shown in Figures 2-1 and 2-2. The Area A landfill, which operated from the mid-1940s until approximately 1974, was used for the disposal of metal plating and parts cleaning sludge, paint-stripping residue, various chlorinated organic solvents, overage chemicals, pesticides, asbestos, incinerator ash, fly and bottom ash from the Base power plant, and miscellaneous debris. Wastes from a fire at CASY (Site 22), including drums containing various chemicals, were buried in trenches at Area B in 1971.

Contamination from prior disposal practices at the CALF site has affected the surface and subsurface soil, sediment, surface water, and groundwater. The primary contaminants found in all media at the site are volatile organic compounds (VOCs). Areas of inorganic contamination of surface water and sediments in the surrounding drainage ditches and in the onsite pond also were detected. Groundwater contamination was found in both the water-table aquifer and the Yorktown Aquifer in Areas A and B. The presence of contamination in the deeper Yorktown Aquifer is thought to be due to the breach of a confining layer between the two aquifers beneath much of the CALF area.

Currently, the Base brig facility and a heliport are located over a portion of the Area A landfill. Area B is not used at the present time. Areas A and B are soil-covered and vegetated to minimize surface erosion as they are both adjacent to tidal drainage ditches that convey stormwater runoff to Willoughby Bay.

A NTCRA was implemented at Area B in May 1994 and completed in January 1995 to remove the primary source areas of contamination. The CALF site RI/FS was completed in 1994 (Baker, 1994b). A Decision Document (DD) (Baker, 1993) was signed in July 1995 requiring localized treatment of groundwater and soil using vacuum extraction. Plans for remediation of the site called for implementation of a groundwater extraction and treatment

system to remediate groundwater underlying Areas A and B and CASY identified in the Area A landfill.

Continuous operation of the groundwater extraction and treatment system began in November 1998 and consisted of pump-and-treat systems for groundwater remediation installed in Area A (for Yorktown groundwater in the western part of the area and for surficial groundwater in the northern part of the area) and in Area B (for both surficial and Yorktown groundwater). A dual-phase vapor extraction (DPVE) system was completed and began operation in May 1998. Groundwater samples were collected from monitoring wells in March 1997 and June 1998 to provide baseline information on water quality before the extraction system was started. The extraction wells were sampled in August 1997 to provide information on water quality prior to system startup. Ecological sampling of surface water and sediment was performed in the Fall of 1997.

The Long-term Monitoring (LTM) Plan for CALF groundwater remediation systems calls for annual sampling of up to 50 monitoring wells and five stream locations for the target compound list (TCL) VOCs during the initial eight 8 years of monitoring. Sampling has occurred in May 1999, March 2000, March 2001, March 2002, March 2003, March 2004, March 2005, March 2006, and March 2007. During the Summer of 2000, an aquifer pumping test study was conducted and groundwater modeling was completed during Fall 2000 to delineate the extent of the capture zones for the individual extraction wells. In addition, the system operational data collected by Shaw Environmental & Infrastructure (Shaw E&I) is reviewed quarterly to assess the performance of the remediation system. Based on recommendations from these reviews, adjustments may be made to both the treatment system operations and the monitoring program to optimize the efficiency of the system operations. The LTM results through the 2006 monitoring are documented in the *Final 2006 Annual Long-Term Monitoring Report for Three Sites* (CH2M HILL, 2007). The 2007 analytical results for CALF will be discussed in the 2007 LTM report, which is currently being prepared at the time of this report.

2.1.2 Site 2—NM Slag Pile

The NM Slag Pile (Figure 2-3) is a one-acre disposal area for slag generated by an aluminum smelting operation during the 1950s and 60s. The slag is a residual cinder material formed from the fusion of a mineral such as limestone with impurities from the aluminum ore and ash from the blast furnace fuel. In order to create a level surface upon which the slag could be deposited, fly ash and/or bottom ash (derived from coal burning operations elsewhere at NSN) were also used as fill material at the site. During the smelting operation, the slag pile area was defined by a lack of vegetation around the site proximal to the slag pile. The site surface has since been regraded and vegetation was planted. Prior to remediation activities, the surface of the site consisted of a gravel parking lot and open grassy field.

The potential for site contamination from metals, including chromium, cadmium, and zinc, was identified in the 1983 IAS (ESE, 1983). Trace amounts of inorganics were detected in surface soil, surface water, and sediment samples taken during the 1988 IRPRI (Malcolm Pirnie, 1988). However, the samples were taken after site regrading and placement of gravel surfacing. Since these activities disturbed the surface soil, these analytical results may not be representative of potential subsurface contamination at the site.

The 1998 RI conducted at the site concluded that the disposal activities had impacted the groundwater and soil at the site as well as sediment and surface water in the adjacent drainage channel. In correlation with the type of material disposed at the site, the primary contaminants consist of metals including arsenic, antimony, cadmium, chromium, copper, iron, lead, nickel, silver, and zinc. However, significant concentrations of organic chemicals (4,4'-dichlorodiphenyldichloroethene [DDE] and trichloroethene [TCE]) were also detected. Sediment and surface soil sampling was conducted in February of 1998 to delineate the contamination limits for a sediment removal action.

Initially, sediment contamination was being addressed separately from other media through an EE/CA. Design plans and specifications for the sediment removal action were prepared in spring and early summer of 1998. The final RI (CH2M HILL, 1998a) and FS (CH2M HILL, 1998c) documents for the entire site were completed in 1998. The final Remedial Action Design for the sediment removal program was submitted (CH2M HILL, 1999) and approximately 2,000 cubic yards (yd^3) of sediment were removed in November 1999. The final ROD (CH2M HILL, 2000a) was approved in December 2000. In February 2000, an asphalt and soil cover was placed over the extent of the site.

The post-closure monitoring plan consists of the annual collection of sediment, surface water, and groundwater samples for Target Analyte List (TAL) metals analysis. The first five rounds of sampling were completed in October 2000, May 2001, June 2002, and June 2003, and June 2004. In 2004, statistical analysis results indicated that the concentrations of site constituents were decreasing in groundwater. In addition, the concentrations of site constituents in the surface water and sediment demonstrated little change since the remedial actions at the site. Therefore, based on the ROD, it was recommended that the LTM groundwater sampling be reduced to a period of once every five years and sediment and surface water LTM sampling be discontinued. The next LTM groundwater sampling is scheduled for June 2009. The LTM results through the 2006 monitoring are documented in the *Final 2006 Annual Long-Term Monitoring Report* (CH2M HILL, 2007). In preparation for the upcoming five-year review, sediment samples were collected in June 2007 and analyzed for lead. The sediment analytical results will be discussed in the 2007 LTM report, which is currently being prepared at the time of this report.

2.1.3 Site 3- Q-Area Drum Storage Yard

The Q-Area Drum Storage Yard (QADSY), shown on Figure 2-4, was previously a compound that occupied approximately five acres in the northwest corner of the NSN near the carrier piers. This area of the NSN was created by dredging operations in the early 1950s. The QADSY was an open earthen yard that was used from the 1950s until the late 1980s to store tens of thousands of drums. Most of the drums contained new petroleum products, various chlorinated organic solvents, paint thinners, and pesticides. Previous investigations showed dark stains on the soil and oil-saturated soil throughout the storage yard, indicating past spills. The northern portion of the yard, which was used to store leaking or damaged drums and hazardous materials, was particularly stained. These drums have been removed, and the site is not currently used.

In 1986, Navy fire inspectors expressed concern with the oil-saturated soils at the northern end of the storage area (previously used to store damaged or leaking drums). On the basis of a potential fire hazard, the top 6 inches (in.) of soil was excavated from an area of 4,240

square yards (yd^2) (totaling approximately 750 yd^3 of soil removed) in the northern section and disposed offsite in 1987. Following the removal action, this area of the storage yard was paved.

An RI/FS (ESE, 1996a) for this site and revealed that the soil was contaminated with total petroleum hydrocarbons (TPH), VOCs, and pesticides. In addition, VOC contamination was found in the groundwater beneath the site and outside the site boundary. The shallow groundwater beneath the hazardous materials area and the northern portion of the petroleum products area was impacted the most. Some low VOC levels were also observed in the deep wells. This may be due to the lack of a confining layer between the two aquifers in this area. The general extent of the groundwater plume, which affects approximately 29 acres beneath the fleet parking area west of the site, has been defined with monitoring-well and direct-push groundwater sampling.

The DD (ESE, 1996b) for the site was signed in November 1996 and calls for remediation by air sparging and soil-vapor extraction (AS/SVE). A pilot treatability study was performed and the system was constructed. The remediation system began operation in August 1998. Several monitoring wells were sampled for VOCs in February 1998 and in May 1998 to provide baseline water-quality data before the remediation system was started.

The LTM plan for the QADSY currently includes the biannual sampling of monitoring wells for VOCs and TPH. The first nine rounds of monitoring were completed in February 1999, August 1999, March 2000, August 2000, February 2001, December 2001, February 2002, August 2002, and March 2003. Based on the significant reduction of VOC concentrations during the first year of operation, the system operation was modified during September 1999, to a 2-week cycle of pulsing. The system operational data collected by Shaw E&I and the monitoring data collected by CH2M HILL were reviewed quarterly so that the system operations and monitoring program could be adjusted as necessary.

In July 2002, the NSN Tier 1 Partnering Team agreed to a proposed close-out strategy for AOC 1. The close-out strategy included the accelerated remediation proximal to CMW-101 to address the high concentrations of vinyl chloride (VC), followed by continued monitoring, and ultimately the shut down and dismantling of the system. The accelerated remediation was accomplished by the extension of the treatment system and installation of a new AS well proximal to well CMW-101. The close-out strategy was implemented on April 4, 2003 when the new AS well began operation. Following the installation of the new AS well, four rounds of monitoring data were collected and showed that the concentrations of VC in well CMW-101 have decreased substantially from 92 micrograms per liter (µg/L) (February 2003, prior to installation of the new air sparge well) to below the detection limit (February 2005). As planned based on the close-out strategy for the site, the air sparge system was shut down in June 2005. The initial sample following shutdown of the system (August 2005) indicated that the concentrations of VC remained below the cleanup goal. However, subsequent monitoring events have reflected VC concentrations above the cleanup goal. Currently, the Tier 1 Partnering Team is evaluating the latest LTM monitoring results and the natural attenuation parameters that were collected to determine if attenuation/degradation is occurring.

Eight LTM sampling events (August 2003, February 2004, August 2004, February 2005, August 2005, February 2006, August 2006, and February 2007) have been conducted since

the additional AS well began operation. The continued monitoring will include only the wells (CMW-101 and CMW-103R) that demonstrated recent exceedances of the cleanup goals. Data will be reevaluated and the NSN Tier I Partnering Team will determine if the AS/ SVE system can be dismantled.

Like AOC 1, a close-out strategy for AOC 2 was also implemented in June 2006 with the installation of an additional AS well proximal to CMW-202 to treat TCE and VC. As part of the close-out strategy for AOC 2, three rounds of LTM have conducted at all of the monitoring wells following the installation of the new AS well. Currently, the LTM data is being evaluated to identify those wells that have demonstrated concentrations of VOCs consistently below the cleanup goals that will be recommended to be removed from the monitoring program. Per the exit strategy, analytical data for those wells that continue to demonstrate VOC concentrations above the cleanup goals will be evaluated and if the VOC concentrations are non-detect or detected at concentrations that are below the cleanup goals, then it may be proposed that the system be shut down and an additional two rounds of LTM be completed at the select wells. If the VOC concentrations remain below the cleanup goals, then it may be proposed that the AS/SVE system at AOC 2 be dismantled.

However, if after the initial two rounds of LTM are complete, the VOC concentrations at the select wells have decreased but remain above the cleanup goals or have stabilized, two additional rounds of LTM will be conducted at the select wells. Following these two additional rounds of LTM, if the data indicates that the VOC concentrations have decreased or stabilized, it is proposed that the system be shut down and LTM continue for an additional four rounds. Following the additional four rounds of LTM sampling, if the analytical results indicate that the VOC concentrations have decreased or stabilized, it is proposed that the AS/SVE system at AOC 2 be dismantled.

Sampling Rounds 10 and 11 were completed in August 2003 and February 2004, respectively (CH2M HILL, 2005b). A total of 13 wells were sampled for TCL low-concentration VOCs during each sampling event. In accordance with the close-out strategy at AOC 1, five monitoring wells were removed from the LTM because the VOC concentrations were consistently below the cleanup goals. Rounds 12 and 13 were completed in August 2004 and February 2005, respectively, with a total of eight monitoring wells being analyzed for TCL low-concentration VOCs (CH2M HILL, 2006). LTM analytical results from Rounds 14 and 15 were completed in August 2005 and February 2006, respectively, and are presented in the *Final 2006 LTM Report for Three Sites* (CH2M HILL, 2007). The most recent rounds (16 and 17) of semiannual LTM occurred in August of 2006 and in February of 2007. Like the previous two rounds of LTM, two monitoring wells at AOC 1 and eight monitoring wells at AOC 2 were sampled for TCL low-concentration VOCs. The LTM analytical results will be discussed in the 2007 LTM report, which is currently being prepared at the time of this report.

2.1.4 Site 6-CD Landfill

The CD Landfill site occupies approximately 22 acres and is located just east of Hampton Boulevard and south of the Naval Exchange, as illustrated in Figure 2-5. The site incorporates two areas of landfilling operations—the easternmost (unpermitted) section and the western (permitted) section. The unpermitted portion of the landfill operated from 1974

to 1979 and was used for demolition debris and inert solid waste, fly ash, and incinerator residue.

In October 1979, NAVFAC received a permit from the Virginia Department of Health to use the landfill (western portion) for disposal of demolition debris and other non-putrescible wastes, excluding fly ash, incinerator residues, chemicals, and asbestos. Blasting grit used for sandblasting cadmium-plated aircraft parts was deposited at the landfill until 1981 when the blasting grit was tested and found to exceed the USEPA Extraction Procedure (EP) toxicity limit for cadmium. The grit was classified as a hazardous waste and onsite disposal of the material ceased. Landfilling operations continued in the western portion of the site until 1987. At the time the landfill permit was granted, a portion of the southeast corner of the site was removed and regraded to allow for runway expansion at the NAS. The design of the runway expansion specified that excess material was to be spread over the landfill and not removed from the site.

In 1993, Seabee Road was constructed over the site and opened to the public. Construction plans required only the addition of fill material; no cutting or grading into the existing landfill occurred. Most of the existing debris mounds situated in the north-central portion of the landfill were leveled and spread around the site to reduce the amount of standing water that accumulated after rain events.

The results of several investigations (performed in 1993 and 1994) guided the scoping of the RI. The RI was completed in three separate rounds of sampling. Soil, sediment, groundwater, and surface water samples were collected. As a result of the Remedial Investigation/Risk Assessment (RI/RA) Report (Baker, 1995a), an FS (Baker, 1996b) was prepared in July 1996 to address contaminated media at the CD Landfill site. Potential risks associated with contaminants in the soil, sediments, and groundwater (including surface water) were identified and guided the development and evaluation of the media-specific remedial action alternatives. In addition to the FS, a separate geostatistical analysis was performed to evaluate and better define the areas of sediment contamination.

A 1996 DD (Baker, 1996d) for the contaminated sediments (designated as Operable Unit [OU] 1) outlined a removal action for sediments at the CD Landfill that exceeded the Effects Range–Medium (ER-M) levels. Removal of heavy metal and pesticide-contaminated sediments was partially completed in Fall 1997 but was postponed during the winter because of inclement weather. When the OU 2 (soil and groundwater) landfill cap was designed, the cap was extended to cover the remaining contaminated sediments, so no further removal will be required. In June 1997, the Partnering Team agreed to an additional sampling event to characterize the fill material and determine closure requirements. A statistical sampling approach was developed to determine within a specified confidence interval whether the fill material would be classified as hazardous. All of the samples collected and analyzed during the June event were below the regulatory standards. Based on the statistical findings, the fill material at the CD Landfill is not considered a hazardous waste and it was agreed that the site would be closed under the Virginia Solid Waste Management Regulations for a construction/ demolition/debris landfill.

A Proposed Remedial Action Plan (PRAP) for OU2 (Baker, 1998a) identified the preferred alternative, a synthetic flexible liner capping system with groundwater monitoring with institutional controls, for the CD Landfill. The final ROD was issued on September 28, 1998

(Baker, 1998b). The construction of the landfill cap was completed in December 1999. As a requirement of the Virginia Solid Waste Management Regulations (VSMWR) (Part D of 9 VAC 20-80-270) the CD Landfill is part of the LTM program at NSN with groundwater and surface water monitoring as well as annual inspections and maintenance of the landfill's environmental controls for 10 years after the closure was completed. The groundwater-monitoring program initially consisted of sampling eight monitoring wells on a quarterly basis for one year, followed by semiannual monitoring for selected analytical parameters. The initial four years of groundwater monitoring were completed in 2000, 2001, 2002, and 2003. The analytical data from the first four years of monitoring are discussed in the *Final Annual Post-Closure Monitoring Report for 2003* (AGVIQ/CH2M HILL, 2004), and in the 2004 *Final First Determination Report for Site 6, CD Landfill* (CH2M HILL, 2004a). The final 2005 Annual Report (CH2M HILL, 2006) summarizes the results of the LTM for the period between February 2005 through August 2005 and compares the monitoring results to baseline monitoring (2000) as well as previous LTM events.

Based on the statistical analysis of the Phase I and Phase II data, as discussed in the *Final First Determination Report for Site 6, CD Landfill* (CH2M HILL, 2004a), it was recommended that the Phase II monitoring be discontinued and the Phase I monitoring be reinstated at the site. Therefore, during the 2004 and 2005 monitoring events, semiannual groundwater samples were collected and analyzed for groundwater indicator parameters (specific conductivity [SC], pH, total organic carbons [TOC], and total organic halogen [TOX]). Overall, the indicator parameters appear to be relatively consistent over the sampling events performed thus far. There were two single exceedances for TOC and SC.

A meeting between the Navy and VDEQ was held in October 2006 to discuss the status of Site 6 as it relates to following the CERCLA process and the Virginia Solid Waste Management Regulations (VSWMR). Additionally, options for path forward were discussed. The Navy submitted a groundwater monitoring plan to VDEQ that details the proposed sampling approach and the analytical parameters for the Site 6 groundwater monitoring plan in March of 2007. For the initial monitoring event, eight monitoring wells were sampled and analyzed for the VSWMR Table 5.1 constituents. Following the initial event, groundwater samples will be analyzed for VSWMR Table 5.5 analytes plus the Table 5.1 analytes that were detected during the initial event. All eight of the monitoring wells are to be sample quarterly for the first two years, then semiannually for the third year. These ten rounds of sampling will comprise the data set for the first corrective action site evaluation report. Currently, three sampling events have been conducted as part of the initial year of monitoring activities.

2.1.5 Site 18-Former NM Waste Storage Area

The NM storage area is located in the southeastern corner of NSN, as shown on Figure 2-6. It was used from 1975 to 1979 to store drums of hazardous waste, consisting of waste oil, metal plating solutions and sludges, chlorinated organic acids (including TCE and 1,1,1-trichloroethane [TCA]), and paint stripping solutions. The storage area was an open, unpaved yard east of the metal storage buildings in the NM area (Taussig Can Area). Spillage of waste oil and hazardous wastes occurred in this area, including an intentional spill in July 1979. As a result of this spill, a pit was excavated and an existing drainage ditch was widened and lengthened to channel the waste oil and contaminated runoff into an

unlined pit. Oil and contaminated water were periodically pumped from the pit and transported to a wastewater treatment plant. Soil in the area of the spill was sampled and found to be contaminated primarily with chromium and cadmium. However, the soil was classified non-hazardous based on USEPA Extraction Procedure toxicity testing. A one-time landfill permit was obtained in October 1980 from the Virginia Department of Solid Waste for the disposal of the contaminated soil at the site by grading and seeding it to establish a vegetative cover. The permit required continuous monitoring of the shallow groundwater and surface water to determine if contaminant transport was occurring (ESE, 1983). The monitoring program was conducted over 55 months. In October 1985, the State Water Control Board agreed to discontinue the monitoring on the basis that no significant contamination was observed.

In 1995, a RCRA inspection was conducted and concluded that no signs of adverse impacts or threats to human health or the environment were observed; therefore, the site was no longer subject to RCRA inspections. In addition, two surface soil samples were collected during the 1995 Phase I RRR Study (Baker, 1996a) and analyzed for VOCs, semivolatile organic compounds (SVOCs), metals and cyanide, and pesticides/polychlorinated biphenols (PCBs). The soil analytical results show that the concentrations of arsenic and benzo(a)pyrene exceeded the USEPA residential RBCs. The arsenic concentration also exceeded the industrial RBC. However, the benzo(a)pyrene concentration was detected at levels consistent with background. On the basis of RRR-Phase I, Site 18 was determined to be a NFA site.

In Fall 2000, the NSN Partnering Team reevaluated Site 18 because the NFA determination was based on industrial RBCs. The NSN Partnering Team recommended additional investigation at the site to evaluate the results against USEPA residential RBCs. The initial phase of the investigation was conducted in June 2001 and consisted of the installation and sampling of three monitoring wells. Based upon the findings from the initial investigation, additional monitoring wells were installed in February 2002 to further delineate the contamination at the site. The groundwater analytical results from both phases of the field investigation indicate that the RBCs and drinking water MCLs were exceeded for four VOCs (1,4-dichlorobenzene, cis-1,2-dichloroethene, TCE, and VC). In addition, there were metal concentrations of arsenic, thallium, and iron that exceeded the residential screening criteria. The results of the field investigations are discussed in the *Final Site 18 Site Investigation Report* submitted by CH2M HILL in November 2002.

In an effort to fill data gaps identified by the NSN Tier I Partnering Team, additional characterization of the site soil, sediment, surface water, and groundwater was conducted in December 2002. Two deep monitoring wells were installed to evaluate vertical transport of site constituents. In addition, surface and subsurface soil samples were collected across the site and sediment and surface water samples were collected in the drainage channel adjacent to the site. The results of the additional investigation are presented in the *Final Expanded Site Investigation Report for Site 18* submitted by CH2M HILL in July 2004. In addition, a membrane interface probe (MIP) survey was recommended to further delineate the horizontal and vertical extent of the VOCs in the subsurface groundwater at the site. An additional round of sampling at the two existing monitoring wells was collected to track VOC concentrations over time. The MIP study and collection of groundwater was conducted in December 2004. Based on the MIP study and groundwater sampling, an

additional groundwater investigation was recommended for further site evaluation. The additional activities included the installation of three monitoring wells (MW08S, MW09S, MW10S) to confirm the MIP results and to collect groundwater samples from the three newly installed wells and three existing monitoring wells (MW03S, MW03C and MW05S). Based on the analytical data and a preliminary MNA evaluation, there is evidence for biodegradation of TCE. In addition, relatively high concentrations of cis-1,2-DCE compared to TCE levels and the presence of VC suggest that anaerobic biodegradation (reductive dechlorination) is occurring at the site. Currently, an EE/CA is being prepared to detail an interim groundwater action focused on the MW03 cluster hot spot.

2.1.6 Site 20-LP-20 Site

As shown in Figure 2-7, Building LP-20 is one of many large buildings located northwest of the NAS main runway. Currently, the building houses the PWC's Transportation Department. In the past, a portion of the building was used for aircraft engine overhaul and maintenance. Previous activities at the building included painting, X-ray facilities, cleaning and blasting, and a metal-plating operation. Waste products generated from these activities were transferred to the industrial wastewater treatment plant (WWTP) via underground piping. In addition, a large fuel storage area, known as LP fuel farm, is also located south of the building. An underground pipeline extends from the Fuel Farm to buildings LP-78 and LP-176 located east of the site. Over the years (1940s to 1990s), numerous spills or releases of wastewater and petroleum have been documented. Significant releases were associated with damage to underground wastewater lines during construction activities, and leakage of the underground petroleum pipeline.

Investigations at the site began in 1986 following a release of JP-5 fuel from the underground pipeline. Since 1986, approximately ten separate investigations have been conducted to evaluate the extent of releases from underground fuel pipelines, the industrial wastewater line, and various USTs at the site. These investigations determined that significant amounts of free product as well as chlorinated solvents are present. An RI and FS summarizing the previous investigation data were completed in 1995 (Baker, 1995b) and 1996, respectively (Baker, 1996c).

The data generated during the RI indicate that VOCs are the primary contaminants detected in the area. Specifically, chlorinated solvents were detected in the vicinity of LP-20 and LP-26. In addition, petroleum products are present east of Building LP-22 and south of Building LP-179. Concentrations of VC, 1,1-dichloroethene, 1,2-dichloroethene, 1,2-dichloroethane, TCE, and benzene were observed in the shallow aquifer (Columbia). Furthermore, concentrations of VC, 1,2-dichloroethene, and TCE were also detected in the deep aquifer (Yorktown).

As a result of the free product at the site, two product recovery systems were installed south and southeast of Building LP-22. Product Recovery System #1 was constructed in 1986, and Product Recovery System #2 was reportedly constructed sometime between 1988 and 1990. Both systems operated four recovery wells that pumped groundwater and product into oil-water separators (O/WS). The O/WS discharged into Bousch Creek and the free product was collected in an aboveground storage tank (AST). Reportedly, neither system performed as anticipated, and both systems were seldom in operation due to mechanical problems. The systems were shut off in December 1994 and dismantled in 1995.

The DD (Baker, 1996e) for the LP-20 site required that contamination at the site be treated to reduce the threat to human health and the environment. The goal of the remedial action was to treat the contaminant plume in the shallow aquifer using an AS/SVE system to prevent migration of the plume offsite and into the deep aquifer, and reduce the contaminant concentrations to established cleanup goals. In addition, aquifer use restrictions (for both the shallow and deep aquifer) were mandated to prevent the groundwater from being used for either a potable or non-potable (industrial water) source.

The construction of the treatment system was completed and began operating on April 14, 1998. The shallow aquifer is treated by an AS/SVE system consisting of 31 air injection wells and 21 vapor extraction wells. The system was placed throughout the center and downgradient extent of the contaminant plume. In addition, several monitoring wells were sampled for VOCs in February 1998 to provide baseline water-quality data before the remediation system was started (CH2M HILL, 1998b).

As a requirement of the DD, the LP-20 site is part of the LTM program at NSN. Monitoring for LP-20 currently consists of an annual sampling of groundwater monitoring wells in the shallow and deep aquifer to track the levels of contaminants at the site and determine if these constituents are migrating offsite or into the deep aquifer. The first round of LTM for groundwater quality at the LP-20 Site was performed in February 1999, after approximately 10 months of system operation (CH2M HILL, 2000b). Annual LTM has continued annually with the most recent round of sampling (Round 10) completed in February 2007.

Round 10 of the LTM sampling consisted of 13 monitoring wells analyzed for TCL VOCs. The continuing effectiveness of the existing AS/SVE system will be evaluated by the Remedial Process Optimization (RPO) Team based upon monitoring results.

2.1.7 Site 22-Camp Allen Storage Yard

CASY operated from the 1940s until 1995 salvaging and processing scrap materials generated at NSN. The CASY is located between Area A and Area B of the Camp Allen Landfill Site, as shown on Figure 2-8. CASY activities have included storage and management of waste oils, used chemicals, and scrap industrial/commercial equipment. Metal smelting, various recycling activities, and miscellaneous burning also occurred at the CASY. In addition, the facility was used to store acids, paint thinners, solvents, pesticides, and transformers. A PCB spill occurred at the CASY in 1989 when a transformer was damaged by a forklift. The PWC responded to the spill and conducted a preliminary cleanup at that time. When operations ceased in 1995, the buildings, incinerators, and rail lines were demolished.

At present, the Virginia Department of Transportation has implemented a plan to extend the I-564 intermodal connector to the Norfolk International Terminals. The highway expansion will require that local utilities, Navy-owned ballfields, and a rail line be relocated impacting the northernmost section of the Salvage Yard. As a result, the Salvage Yard will be covered and ballfields have been proposed for construction at the site to replace those demolished during the highway expansion.

A Preliminary Assessment/Site Inspection (PA/SI) was completed for the CASY (Baker, 1994a) and the investigation results indicated that the surface and subsurface soil were contaminated with PCBs, pesticides, and metals. Additional data were generated during the

RI (Baker, 1999) and showed that the shallow and deep groundwater aquifers in the vicinity of the site as well as the sediment were contaminated with PCBs and metals. However, the human health risk assessment identified no unacceptable risk from exposure to groundwater for the exposure scenarios evaluated.

The initial remedial action at CASY consisted of the non time-critical removal and offsite disposal of metals and PCB contaminated soils. A PCB removal action began in August of 1998. Additional delineation of site contaminants in 2001 identified six metals hotpots throughout the site. As an interim measure, the Navy began removal of the hot spot soils in conjunction with the on-going PCB removal action. The hot spot and PCB contaminated soil removal continued through 2001 with the ultimate excavation of more than 16,000 yd^3 of material. The removal action achieved the soil PCB cleanup goals, however, the additional soil analytical data showed that the aerial extent of metals contamination was more widespread than previously estimated. It was estimated that approximately 29,000 yd^3 of soil remained at the site above the metals cleanup goals. Based upon the more comprehensive confirmation sampling and anticipated future land use of the site, the remedial measures for the site were re-evaluated. The Navy determined that the placement of a soil cover was more cost effective than removal of the metals contaminated soils, and the NSN Tier I Partnering reached consensus on this course of action in March 2002.

An engineered soil cover and the cover for the sediments in the pond were completed in June 2004. The final ROD addressing the soil and sediment at the site and encompassing the overall soil and sediment cleanup strategy for the site, was signed by USEPA in September of 2004. (Baker, 2004). The ROD identifies the risks to the human health and ecological receptors exposed to soil and sediment, establishes the Remedial Action Objectives (RAOs), and defines the land use controls (LUCs) for the CASY.

2.1.8 Site 23-LP-20 Plating Shop

As shown in Figure 2-7, Building LP-20 is one of many large buildings located northwest of the NAS main runway. Building LP-20 includes the cleaning shop, motor pool, plating shop, and offices (detailed in Figure 2-9). In the past, the building was used as an engine overhaul facility in which jet engines were disassembled and worked on. Currently, the building is used as a motor pool and office space.

Site 23, the LP-20 plating shop is located on the west side of the building but is currently not in use and is locked to prevent unauthorized access. Previous activities in the shop included disassembling, stripping, and replating metal parts. The shop contains seven process pits extending beneath the concrete slab floor which were used for cleaning, stripping, and plating engine parts. The process tanks and equipment were also located in pits. The floor and pits were lined with corrosion resistant brick tiles. The shop also contains a drainage system for the collection of wastewater from the pits and delivery to the industrial WWTP.

During a 1989 site visit, VDEQ observed violations of the Virginia Hazardous Waste Management Regulations (VHWMRs). Violations included hazardous waste stored in its generator container accumulation areas in excess of 90 days, hazardous waste stored in tanks without interim status or a permit, and containers not clearly marked as hazardous waste. Violations also included the lack of inspection records and notification of exact locations of all existing accumulation areas.

An enforcement order was effective in December 1990. Under RCRA, the Clean Closure Plan and Contingency Plan were completed in 1993 and approved by VDEQ in September 1994. The Navy requested a modification of the plans in order to conduct a risk-based closure. Multiple phases of investigation were conducted for partial implementation of the Risk-Based Closure Plan (Versar, 1997). The investigation included the collection of soil, concrete, and groundwater and the analysis for VOCs, cyanide, and eight metals. The risk assessment indicated unacceptable industrial risk at 17 soil locations, but no unacceptable risks with exposure to the plating shop concrete floors. Groundwater was recommended to be addressed under a post closure monitoring program. Final closure was not achieved; however, partial closure including the removal of tanks and most of the piping and either decontamination or disposal as hazardous waste did occur. In September 2000, a revised Clean Closure Plan was submitted to VDEQ. The scope of the revised plan included the removal of the concrete floor and approximately three feet of soil in the plating shop. In addition, the plan included soil sampling of the remaining soils in the shop area as well as the plating sumps and select locations along the industrial wastewater piping system. If the soil samples exceeded established risk-based threshold limits a risk assessment would be conducted. Following the sampling activities, the plan called for general cleanup and decontamination of the Plating shop, the removal or rerouting of underground utilities beneath the plating shop, and the cleaning of portions of concrete slab that are demolished. Currently, there has been no activity at the Plating Shop since the submittal of the revised Clean Closure Plan (Versar, 2000a) and the Contingent Closure Plan (Versar, 2000b).

In July 2003, the Navy decided to move the site from the RCRA to the CERCLA program. A PA/SI is the first step in evaluating a site under CERCLA, however, in November 2003 the NSN Tier I Partnering Team determined that the existing documents completed under the RCRA program can be used in lieu of a formal PA/SI. In addition, the Tier I Partnering Team joint-scoped additional soil investigation activities. The additional investigation was conducted in December of 2004. The results of the investigation showed that there were concentrations of one VOC, SVOCs, and metals above the residential and industrial RBCs.

In May 2005, the NSN Tier I Partnering Team agreed to conduct an interim removal action to address the site soils. A final EE/CA was submitted in December 2006 that summarizes the soil removal action. The construction activities associated with the interim action were initiated in June of 2006.

2.2 Solid Waste Management Units

The SWMUs are described in this section. These SWMUs are listed as SSAs or AOCs in the FFA (see Sections 1.4.3.4 and 1.4.3.5). The following site descriptions include physical characteristics, previous investigations, detected contaminants, and future remediation plans for each site. The objectives of the investigations are to determine the extent of contamination at each SWMU, to develop and evaluate economically feasible remedial alternatives for remedial action at contaminated SWMUs, and to close out qualified sites. A ROD for SWMUs 12 and 16 has been completed which supported no action; therefore, SWMUs 12 and 16 are not included in this section (CH2M HILL, 2005a).

2.2.1 SWMU 14—Q-50 Satellite Accumulation Area

The Q-50 Satellite Accumulation Area (SWMU 14) is located in the northeast corner of NSN, as shown in Figure 2-10. SWMU 14 consisted of a concrete storage pad surrounded by a grass-covered field. The pad served as a 90-day hazardous waste accumulation area where wastes generated through various waste streams were processed (sampled, identified, labeled, and packaged) before being shipped to eventual disposal. The original concrete pad for the accumulation area has since been removed. A new pad was installed west of the original location and is used for temporary storage of investigation-derived waste (IDW) materials.

In addition to the accumulation area, the peninsula at Sewell's Point is a man-made landmass formed from two distinct periods of fill activities. The first landfill activities began in the early 1950s, when the channels were dredged to allow for construction of the northernmost series of piers at the site. The resulting dredge material was used to create much of the land at Sewell's Point. The second period of filling occurred between 1974 and 1978, when the eastern portion of the site was formed from the disposal of construction debris. This landfill was later designated as Site 9, the Q-Area Landfill, and reportedly used for the disposal of non-hazardous construction debris. Site 9 was originally designated for No Further Action in the *Site 9 Q-Area Landfill Close-Out Report, Naval Base, Norfolk, Norfolk, Virginia* (Baker, 1997). However, because Site 9 and SWMU 14 are co-located, the Site 9 soil and groundwater are being evaluated as part of a remedial investigation to determine the potential impact of contamination from SWMU 14.

Sampling and analysis of the surface soil were performed in 1995 during the RRR study. Additional surface soil and groundwater sampling was performed in 1996 during the Phase II RRR study. VOCs, SVOCs, pesticides, and PCBs were detected in the soil and groundwater (Baker, 1996f).

A SWMU Supplemental Investigation conducted in July 1998 (CH2M HILL, 1998d) detected several VOCs, SVOCs, PCBs, and metals in the groundwater at levels above the RBCs. As a result of these findings, three phases of remedial investigations have been conducted in 1999, 2000, and 2001 to assess the extent of the fill material and groundwater impacts. In order to fill data gaps identified by the NSN Tier I Partnering Team, additional investigations were completed in December 2002. The results of all the investigations are presented and discussed in the final SWMU 14 RI Report (CH2M HILL, 2004c). As a result of the RI, it was recommended that the ecological risk assessment progress into the Step 4 phase.

Replacement of the revetment along the shoreline in the area of the site, to repair storm damage from Hurricane has been completed in late 2005. As a result of the revetment construction activities the Step 4 ecological risk assessment was delayed. Additionally, the NSN Partnering Team has agreed that the revetment, along with the paved parking lot, will be considered part of a presumptive remedy for the site soils and the sediment under the revetment.

In September 2006, a Trident Probe investigation was conducted to determine if there were preferential groundwater transport pathways from SWMU 14 to Willoughby Bay and to sample pore water from areas identified as potential discharge locations. The results of the Trident Probe survey indicated that there was not a preferred groundwater discharge

pathway from SWMU 14 into Willoughby Bay. Based on the survey conclusions, the NSN Tier 1 Partnering Team determined that the ecological evaluation was not warranted.

Currently, an EE/CA is being prepared that will outline the possible alternatives for the soil.

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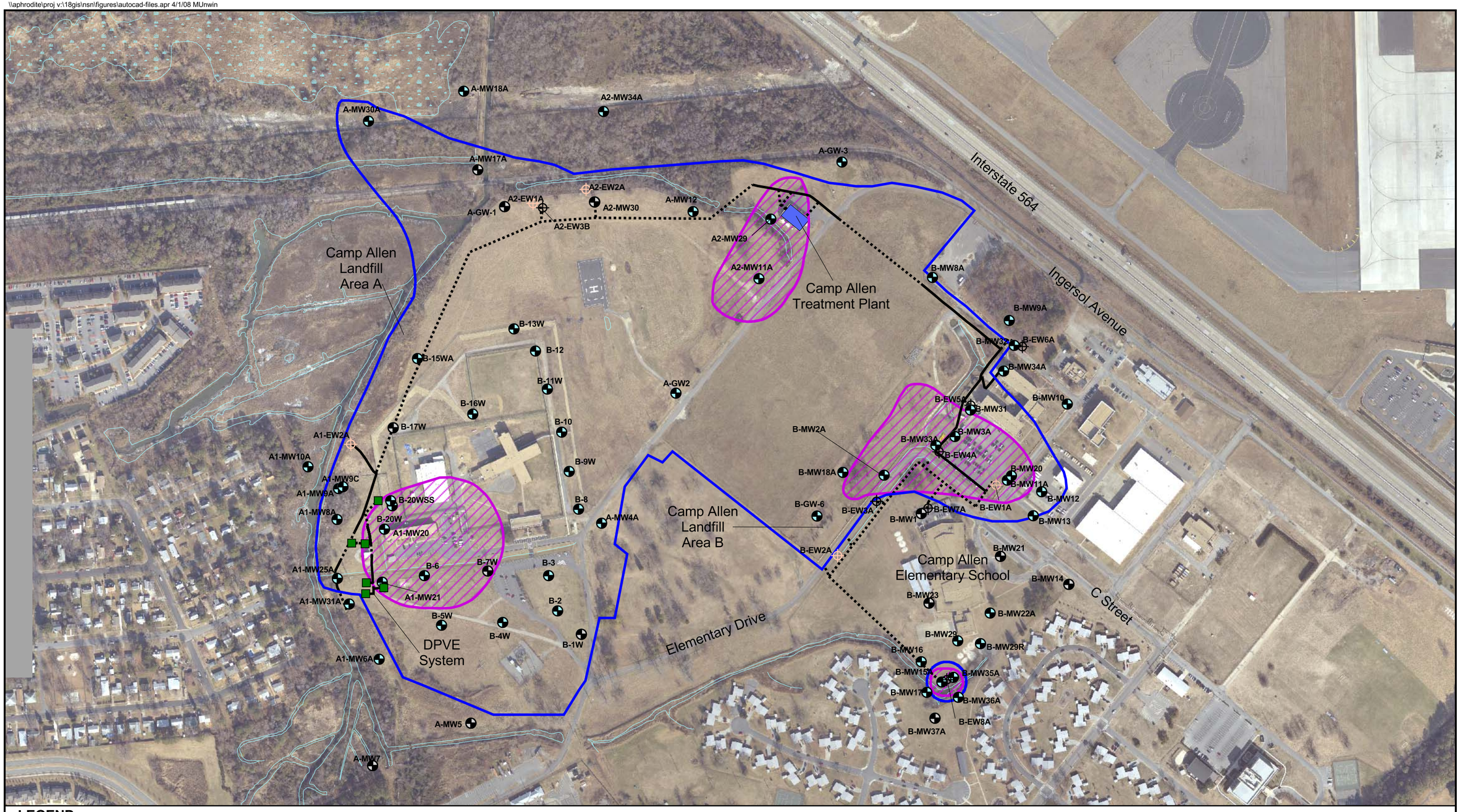

LEGEND

- Shallow Monitoring Well
- Shallow Monitoring Well not included in LTM
- Shallow Extraction Well
- Inactive Shallow Extraction Well
- DPVE Well
- Shallow Aquifer Groundwater Plume
- Land Use Control Area
- Piping for Groundwater Treatment System
- Piping for Groundwater Treatment System (Assumed Location)

N

0 400 800 Feet

Figure 2-1
Site Map - Shallow Aquifer Treatment System,
Monitoring Well Network, and Groundwater Plumes
Site 1 - Camp Allen Landfill
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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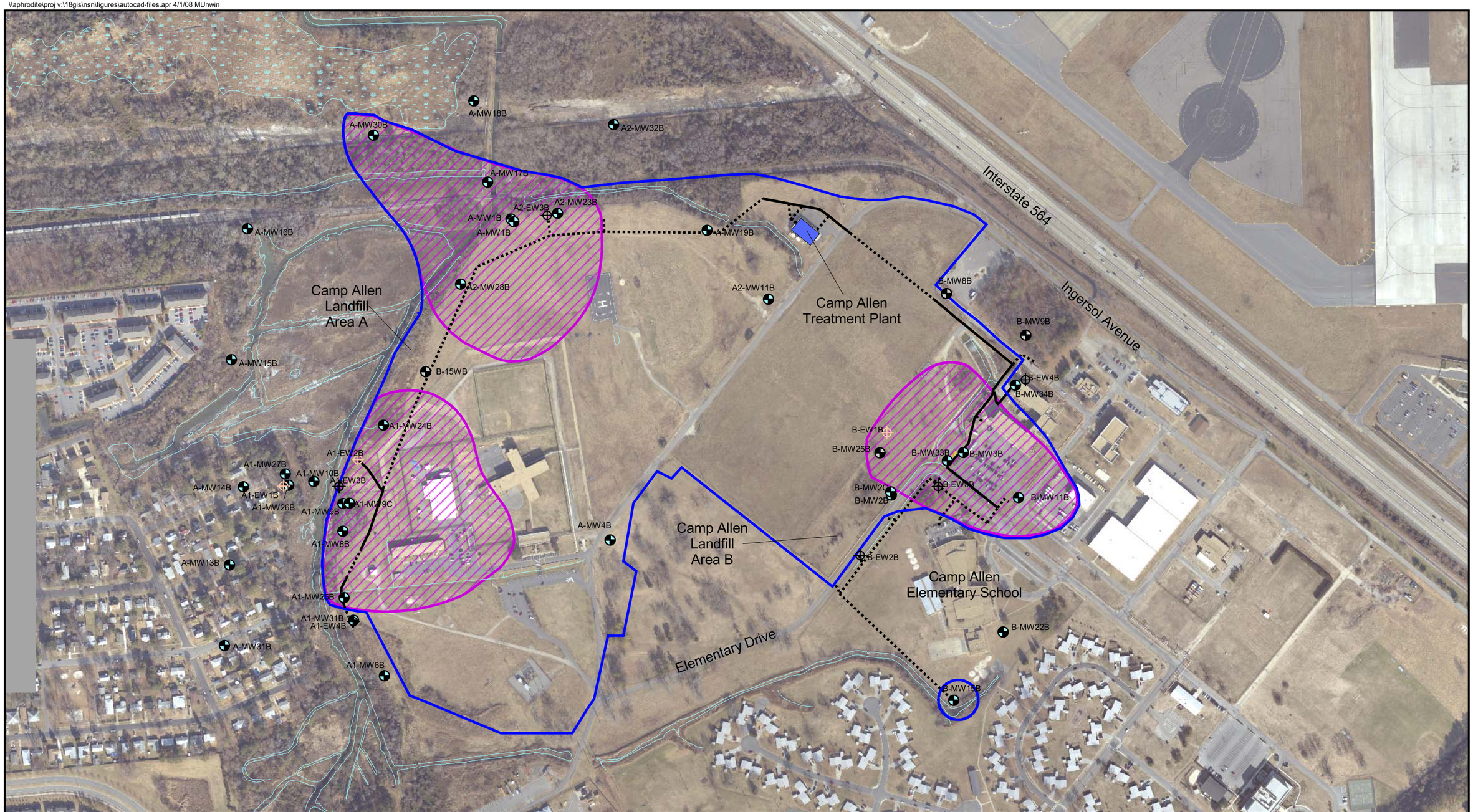

LEGEND

- Deep Monitoring Well
- Deep Monitoring Well not included in LTM
- Deep Extraction Well
- Inactive Deep Extraction Well
- Deep Aquifer Groundwater Plume
- Land Use Control Area
- Piping for Groundwater Treatment System
- Piping for Groundwater Treatment System (Assumed Location)

N

0 400 800 Feet

Figure 2-2
Site Map - Deep Aquifer Treatment System,
Monitoring Well Network, and Groundwater Plumes
Site 1 - Camp Allen Landfill
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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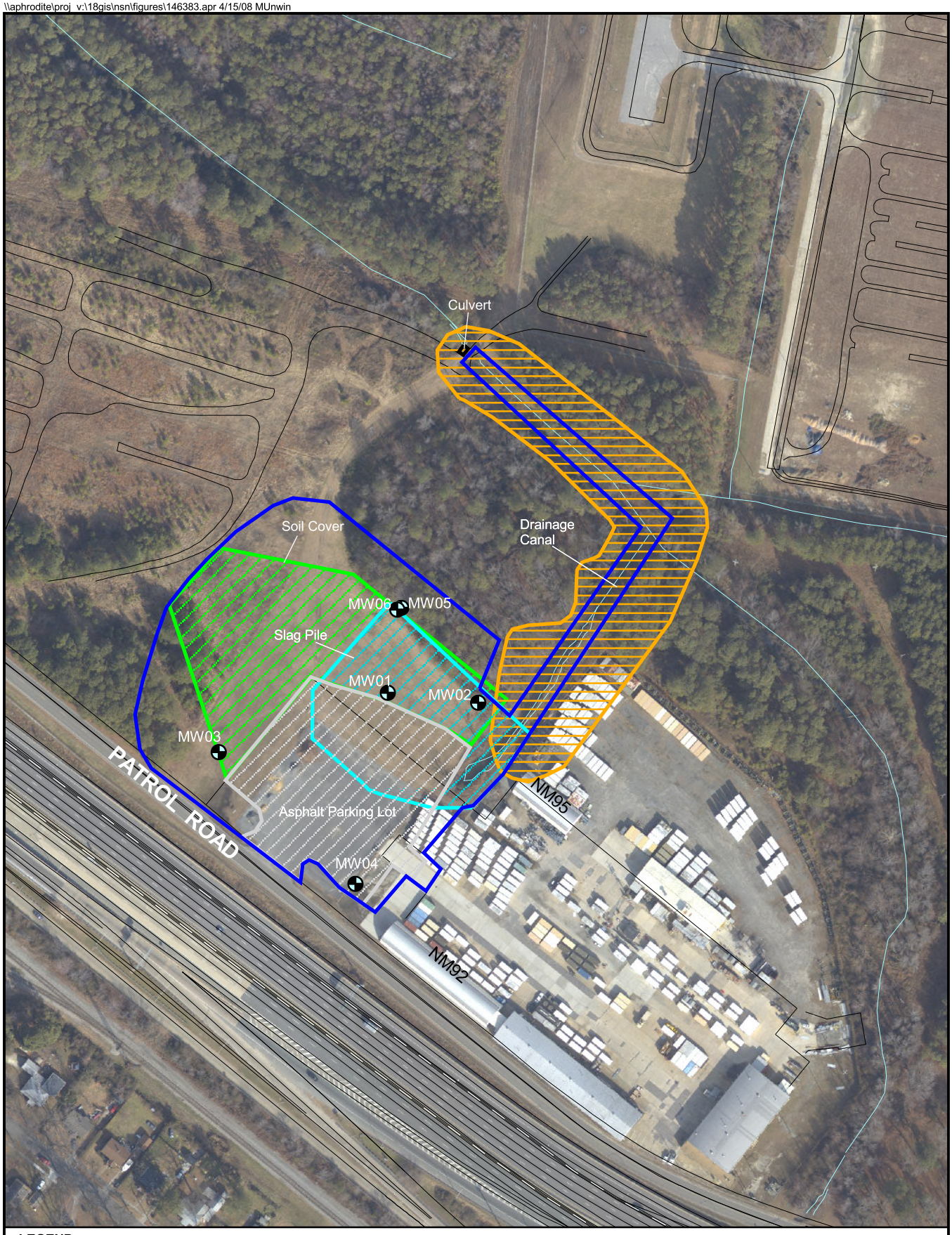

LEGEND

- Monitoring Well
- Land Use Control Area
- Areas of Sediment Removal
- Area of Soil Cover
- Area of Asphalt Cover
- Approximate Location of Slag Pile Area

N

0 100 200 Feet

Figure 2-3
Site Map
Site 2 - NM Slag Pile
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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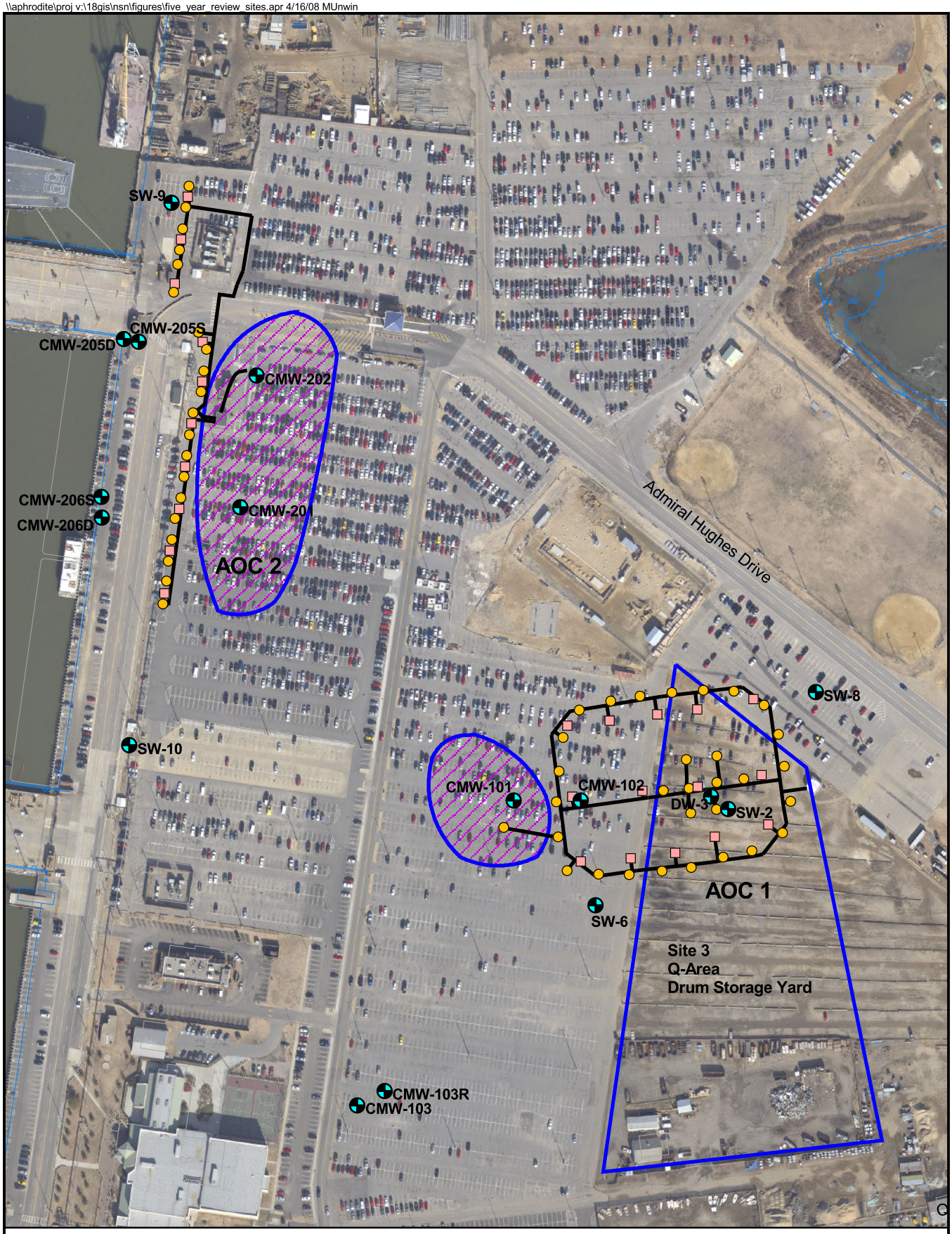

LEGEND

- Air Sparge Wells
- Soil Vapor Extraction Wells
- Piping for AS/SVE Systems
- Land Use Control Area
- Monitoring Wells
- Shallow Aquifer Groundwater Plume

N

0 125 250 Feet

Figure 2-4
Site Map
Site 3 - Q-Area Drum Storage Yard
AOC 1 and AOC 2
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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LEGEND

- Monitoring Wells
- Areas of Sediment Removal
- Soil Cap - Remedial System Caps/Covers
- Land Use Control Area
- Drainage Ditch

N

0 200 400 Feet

Figure 2-5
Site Map
Site 6 - CD Landfill
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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LEGEND

Site Boundary

Monitoring Wells

N

0 50 100 Feet

Figure 2-6
Site Map
Site 18 - Former NM Hazardous Waste Storage Area
Naval Station Norfolk
Norfolk, Virginia

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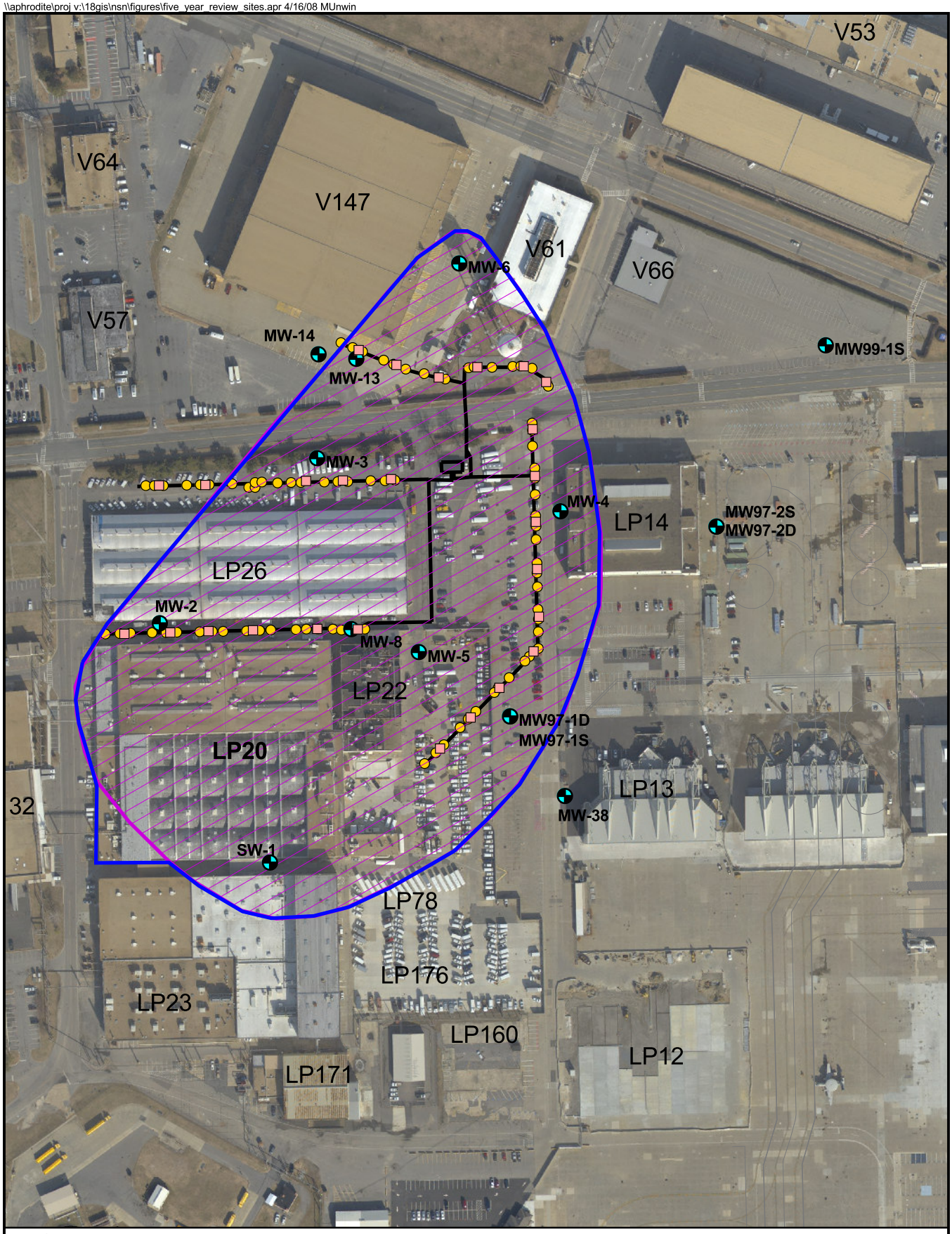

LEGEND

- Air Sparge Wells
- Monitoring Wells
- Soil Vapor Extraction Wells
- Piping for AS/SVE Systems
- Land Use Control Area
- Estimated Plume

N

0 130 260 Feet

Figure 2-7
Site Map
Site 20 - LP-20 Site
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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LEGEND

- Soil Cover
- Sediment Cover
- Land Use Control Area

N

0 130 260 Feet

Figure 2-8
Site Map
Site 22 - Camp Allen Salvage Yard
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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Figure 2-9
Site Map
Site 23 - Building LP-20 Plating Shop
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

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LEGEND

- Monitoring Wells
- Estimated Extent of Site 9 Landfill

N

0 100 200 Feet

Figure 2-10
Site Map
SWMU 14 - Q-50 Satellite Accumulation Area
Naval Station Norfolk
Norfolk, Virginia

CH2MHILL

SECTION 3

Screening, Categorizing, and Prioritizing Sites at Naval Station Norfolk

3.1 Federal Facilities Agreement

On February 18, 1999, the USEPA Region III and the Department of the Navy entered into a FFA for NSN. One of the objectives of the FFA is to define a site-screening process (SSP) intended to provide a simplified investigative method to identify SSAs and AOCs for evaluation and determine whether Remedial Investigations are required for these areas.

3.1.1 Determining Site Screening Areas

If the USEPA or Navy determines that an area on NSN, which has not been previously identified as a SSA, poses a threat to public health or the environment, the other party shall be notified. The parties will then have 45 days from the notification to discuss the site conditions and determine if the site shall be addressed under the FFA as a SSA.

3.1.2 Establishing a Site Screening Area

Any site that is established as a SSA will be added to the list in Appendix B of the FFA as an additional SSA. This may lead to an investigation and possible remediation in accordance with the requirements of the FFA. For any new SSAs, the Navy shall include in the next Draft Amended Site Management Plan a proposed time schedule for the submittal of a SSP Work Plan. This schedule shall be approved in accordance with Section XI of the FFA.

3.1.3 Site Screening Process

The Navy shall submit to the USEPA a SSP Work Plan, which outlines the activities necessary to determine if there has been a release of hazardous constituents to the environment. The scope of work shall be mutually agreed to by the USEPA and the Navy. The SSP Work Plan shall also include a schedule for the submittal of the SSP report, which will be incorporated into the Site Management Plan. The SSP shall also include the following:

1. Upon conclusion of a SSP, the Navy shall submit to the USEPA a draft SSP Report which shall provide the basis for a determination that either: a) a RI/FS be performed on the area addressed by the SSP or, b) the area does not pose a threat to the environment and therefore, the area should be removed from further study under the FFA.
2. Within 60 days of receipt of the final SSP Report, the USEPA and the Navy will determine if the SSA(s) will require a RI/FS.
3. For those SSAs which the USEPA and Navy agree do not warrant an RI/FS, the Navy shall prepare a DD that reflects that agreement. The agreement is to be signed by all the Project Managers.

4. For those SSAs that are to proceed with a RI/FS, OUs will be established. A schedule for the submission of the RI/FS Work Plan(s) is to be developed and incorporated into the next update of the SMP.

3.1.4 Areas of Concern

For those areas that have been identified as AOCs, the Navy and USEPA will go through a screening process as detailed below:

1. A document evaluation will be undertaken to review existing documentation and assessing information concerning the handling of hazardous waste at each AOC. The evaluation could also include (if agreed to by both USEPA and the Navy) discrete sampling without developing a work plan.
2. Based on the document evaluation, the Project Managers will decide which AOCs will proceed to the SSP as SSAs and which AOCs will require no further action.
3. For those AOCs that will not proceed to the SSP, the Navy shall prepare, with USEPA assistance, a brief AOC close-out document. The USEPA shall provide a response to the Navy within 30 days of receipt of the supporting documentation.
4. Those AOCs, which are not agreed upon by USEPA and the Navy to be closed out, will proceed to the SSP. These sites will have schedules established for submittal of SSP work Plans. The schedules will be incorporated into the SMP.

3.2 Site Screening Process Tools

Although the FFA provides an outline of the SSP for closing out SSA, the FFA does not provide a detailed process for site screening. As a result, The Tier I Partnering Team has developed several tools for rapidly screening a site to determine whether the site will require a full RI/FS or if it can be removed from further study. The following section describes the screening tools utilized at NSN.

3.2.1 Relative Risk Ranking

The DoD developed a relative risk framework to evaluate the potential risk posed by a site in relation to other sites. The relative risk evaluation of NSN sites will be performed to give each of the sites a relative risk designation. Relative risk is a management tool that uses actual media concentrations, potential exposure, and potential migration to indicate which sites may pose a risk to human health and the environment. Based on the relative risk results, the Navy can focus available resources for study and remediation on the sites ranked “high.”

This version of the SMP does not update the prior ranking of the sites at NSN. The decision to defer the re-ranking of sites is based on the fact that the sites discussed in this SMP are either undergoing remediation, are in an active site characterization phase, or have been closed out based on a determination of no significant risk to human health or the environment. It is anticipated that the sites undergoing site characterization will be re-ranked in a future update of the SMP. The framework for future ranking is provided below.

The primary factors considered in the relative risk methodology are human health and ecological risks associated with exposure to constituents at the site. The site ranking is based on the best information available at the time the report is submitted. The relative risk model is both quantitative and qualitative in nature.

To initially categorize the sites, contaminant hazard factors (CHFs) for human health and ecological risk are calculated based on available chemical data at the time the ranking is performed for each site. The CHF values are determined by dividing the maximum detected concentration of particular compounds in the environmental media (groundwater, soil, surface water, and sediment) by the appropriate corresponding screening value. To perform this analysis, the most up-to-date version of the relative risk-ranking model should be used.

For the quantitative screening analysis, human health risk will be evaluated assuming that the groundwater is used as drinking water (both ingestion and inhalation exposure scenarios will be included in the drinking water determination). To be conservative, soil ingestion will be assumed under a residential-use scenario. Ecological risk will be determined for the aquatic environment only (surface water and sediment), because benchmark values for terrestrial ecological risk are not readily available.

Once the quantitative assessment is complete, a qualitative assessment addressing potential exposure pathways and potential contaminant transport will be performed. This analysis will be conducted to ensure that sites where human or ecological exposure to the contaminated media exists and the potential for contaminant migration is significant will be ranked higher than sites with less potential to impact human health and the environment. This analysis will be performed by qualitative analysis of the CHFs, receptor factors (exposure potential), and migration pathway factors (contaminant transport potential), as described in the following sections.

A detailed description of the procedures and equations used to complete the relative risk ranking of the sites at NSN is included in the *1999-2000 Site Management Plan, Naval Station Norfolk.*

3.2.2 Aerial Photo Analysis

The September 1994 an EPIC study of aerial photography identified 37 potential WDAs at NSN. This study provided a useful tool for identifying potential SSAs for further investigation by ascertaining such potential indicators of contamination as disturbed areas, ponded liquids, excavated areas, fill areas, stressed vegetation and discolored soils.

However, a more detailed review of additional aerial photos and field verification can also provide supporting documentation for removing sites from further study. Examples of this photographic documentation include demonstrating that the disturbed areas are associated with new building construction activities, confirming that ponded areas are attributed to natural drainage patterns, and illustrating from historical photos that disturbed areas occurred over a short period of time.

3.2.3 Geoprobe Sampling

The use of direct push soil and groundwater sampling techniques, such as the Geoprobe®, can provide a rapid, cost-effective alternative to traditional sampling techniques. These

techniques offer the following advantages over traditional sampling methods: the need for the installation of permanent wells may be reduced or eliminated, the generation of IDW is minimized, the effort to achieve decontamination is reduced, the mobility is much easier than with drilling equipment, and the collection of samples can be conducted much more rapidly.

Although the Geoprobe data generally provide representative soil analytical data, the groundwater data can be used only on a qualitative basis for risk assessments because: 1) the data cannot be reproduced as is the case with well data, and 2) metals data may not be representative due to the high turbidity of the samples. However, the data generated from the Geoprobe investigations can be used to provide a conservative assessment of the nature and extent of soil and groundwater contamination at a particular site. Confirmation data may be required with the installation of monitoring wells; however, the number of wells will likely be significantly reduced.

3.2.4 Steamlined Risk Assessments

Several sites were identified where the available data indicated that the sites seemed to pose minimal risk to human health or the environment. However, a quantitative risk evaluation was warranted before a determination could be made on whether the sites could be closed as NFA sites, or classified as a SSA for further investigation. Conversely, the slight exceedances above the risk-based criteria did not justify a full-scale risk assessment for these sites. Therefore, a streamlined risk assessment process has been applied to these sites, which is described below.

Concentrations of detected chemicals were compared to the following current USEPA screening and regulatory screening criteria for each sample matrix: RBCs for residential and industrial soil, USEPA tap water RBCs and MCLs for groundwater, and the USEPA Region III Biological Technical Assistance Group (BTAG) screening values for surface water and sediment. The SWMUs were initially categorized based on the comparison to screening and regulatory criteria (comparison criteria).

In addition, the maximum, minimum, arithmetic mean, and median concentrations for the contaminants exceeding the comparison criteria were calculated using the detected concentrations from all samples collected during the RRR Study and the SWMU Supplemental Investigation. Although these values were not used in determining the recommendations for each SWMU, this evaluation was performed to identify the detected range for contaminants exceeding the comparison criteria.

SECTION 4

CERCLA Process Activities

As previously discussed in Section 1, NSN was listed on the USEPA CERCLA NPL on April 1, 1997. The Base is being investigated through the IRP. Because the Navy structured the IRP to be consistent with the terminology and structure of the CERCLA Program, the placement of NSN on the CERCLA NPL has had a limited effect on the cleanup processes that were already established. The CERCLA cleanup process is described below. The IRP at NSN is being implemented in accordance with applicable federal and state environmental regulations and requirements.

The FFA developed for NSN by USEPA Region III and the Navy will assist the Navy to meet the provisions of CERCLA, RCRA, and applicable state law. The FFA will establish a procedural framework and provide detailed guidance on all phases of the remedial process from investigation through remedial action. The FFA also incorporates the effects of team partnering on the remediation process. The modified remedial process, incorporating the provisions of the FFA, is discussed in this section.

4.1 CERCLA Process

4.1.1 CERCLA RI/FS Process

The CERCLA RI/FS process refers to the process of site investigation and remedial action that is used for CERCLA sites.

The objectives of the CERCLA RI/FS process are to evaluate the nature and extent of contamination at a site, and to identify, develop, and implement appropriate remedial actions in order to protect human health and the environment. The RI/FS process includes the following major elements:

- RI—Remedial Investigation
- RA—Risk Assessment
- FS—Feasibility Study
- PRAP—Proposed Remedial Action Plan
- ROD—Record of Decision or Decision Document

These steps ultimately lead to either implementation of a RD/RA or the decision to take no action at the site. Where no further action is required at a site, a no-action ROD would be signed and the site removed from the program.

The RI, RA, FS, and PRAP documents are maintained in information repositories for review by the public. A formal public comment period and a public meeting (if required) generally follow the issuance of the final PRAP. Public comments received on the final PRAP are addressed as part of the Responsiveness Summary in the ROD. Subsequent to completion of the ROD, RD/RA activities are initiated. In accordance with CERCLA, remedial action is required to begin within 15 months of the final ROD.

4.1.2 Removal Action Process

Removal actions are implemented to cleanup or remove hazardous substances from the environment at a site in order to mitigate the spread of contamination. Removal actions may be implemented at any time during the RI/FS process.

Removal actions are classified as either time-critical or non-time-critical. Actions taken immediately to mitigate an imminent threat to human health or the environment, such as the removal of corroded or leaking drums, are classified as time-critical removal actions. Removal actions that may be delayed for 6 months or more without significant additional harm to human health or the environment are classified as non-time-critical removal actions.

For non-time-critical removal actions, an EE/CA is prepared rather than the more extensive FS. An EE/CA focuses only on the substances to be removed rather than on all contaminated substances at the site. It is possible for a removal action to become the final remedial action if the risk assessment results indicate that no further remedial action is required in order to protect human health and the environment.

A non-time-critical soil removal action was completed at Area B of CALF in 1994; however, this was not considered a final remedy for the site. A soil removal action also was completed in the Q-Area that involved the removal of 750 yd^3 of petroleum-contaminated soil from the northwest corner of the site to allow construction of a parking lot. In addition, a soil removal action was completed in the NM Area (Taussig Can Area) in 1979 with the approval of the Commonwealth of Virginia.

A soil removal action was completed at the Building W-316 site that involved the removal of PCB-contaminated soil and a removal action was completed at the SP-2B Accumulation Area that involved the removal of lead-contaminated soil. NTCRAs have been completed for pesticide-contaminated soil at the Pesticide Disposal site, metals and PCB-contaminated soil at the CASY, lead-contaminated sediment at the NM Slag Pile, and metals and pesticide-contaminated sediment at CD Landfill.

4.1.3 Remedial Action Process

Remedial actions may be considered interim remedial actions (IRA) or final remedial actions. Interim remedial actions are implemented to provide temporary mitigation of human health risks or to mitigate the spread of contamination in the environment. Similar to removal actions, they may be implemented at any time during the RI/FS process. An IRA is implemented to attain applicable or relevant and appropriate requirements (ARARs) to the extent required by CERCLA or the National Contingency Plan (NCP). It is also consistent with and contributes to the efficient performance of a final remedial action taken at an area or OU. Examples of IRAs include installation of a pump-and-treat system for product recovery from the groundwater or installation of a fence to prevent direct contact with hazardous materials.

For IRAs, a focused feasibility study (FFS) is prepared rather than the more extensive FS. As with the removal action, an IRA may become the final remedial action if the risk assessment results indicate that no further remedial action is required in order to protect human health and the environment. In this case, a no-action ROD would be signed and the site removed from the program upon completion of the IRA.

Following the more extensive FS process, a preliminary/conceptual RD, a pre-final RD, and then a final RD are developed for final remedial action at an area or OU. After completion of the remedial action at each area or OU, a Remedial Action Completion Report will be prepared. If necessary, a LTM Plan and an Operation and Maintenance (O&M) Plan will also be prepared for each remedial action site.

Remedial actions have been constructed at three sites at NSN: CALF, the LP-20 site, and QADSY. A groundwater extraction and treatment system and DPVE system became operational at CALF in July 1997. An AS/SVE system to address chlorinated solvents in the groundwater at LP-20 started operations on April 14, 1998. An AS/SVE system to address TPH and chlorinated solvents in the groundwater started operations at the QADSY in AOC 2 and AOC 1 on August 18, 1998 and August 20, 1998, respectively. Baseline monitoring, supplemental testing, and LTM are currently performed at all three sites.

4.1.4 Treatability Studies

Treatability studies are performed to assist in the evaluation of a potentially promising remedial technology. The primary objectives of treatability testing are:

- To provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the FS
- To support the RD of a selected alternative

Treatability studies may be conducted at any time during the RI/FS process. The need for a treatability study is generally identified during the FS.

Treatability studies may be classified as either bench-scale (laboratory study) or pilot-scale (field studies). Bench-scale studies are often sufficient to evaluate performance for technologies that are well developed and tested. For more innovative technologies, pilot tests may be required to obtain the desired information. Pilot tests simulate the physical and chemical parameters of the full-scale process, and are designed to bridge the gap between bench-scale and full-scale operations.

Pilot-scale treatability studies had been conducted at the CALF site to evaluate air stripping and DPVE technologies. Additionally, SVE and air sparging pilot-scale treatability studies were completed at the Q-Area Drum Storage Area and LP-20 site.

4.2 FFA CERCLA Integration Process

4.2.1 AOC Evaluation

Sites identified as AOCs in the FFA, will undergo a document evaluation. This document evaluation will involve a thorough review of existing or easily obtainable documentation and information on the identified sites. If the Navy and USEPA agree, the evaluation could include obtaining discrete samples from the AOC without the development of a work plan. If both parties do not agree, the AOC evaluation process will continue without the performance of sampling.

The document evaluation will also involve assessing information concerning the handling of hazardous wastes at each AOC, the actions taken at each AOC, or actions that will be occurring under other regulatory programs at each AOC. Based on the AOC evaluation, a decision will be made by the management team regarding which AOCs will proceed to the Site Screening Process as SSAs and which AOCs will require no further action and can be closed out. For those AOCs requiring no further action, an AOC close-out document will be prepared.

4.2.2 Site Screening Process

The SSP refers to the process described in the FFA that will be used to identify whether SSAs should proceed into the RI/FS process under CERCLA. SSAs are those areas that may pose a threat to public health, welfare, or the environment. SSAs can be identified by either the Navy or USEPA. Upon identification of an SSA, a SSP work plan will be prepared outlining the activities necessary to determine if there have been releases of hazardous substances, pollutants, contaminants, hazardous waste, or other hazardous constituents to the environment. After investigation activities have been performed, a SSP report will be prepared. The report provides the basis for a determination that either (1) a RI/FS be performed at the SSA, or (2) the area does not pose a threat to public health, welfare, or the environment and therefore should be removed from further study. For SSAs that do not warrant an RI/FS under CERCLA, a brief decision document will be prepared and signed by all project managers on the management team.

SECTION 5

Site Management Plan Schedules

This section presents project-specific schedules for projects that are or potentially will be active in FY 2008 and FY 2009. In addition, tentative site schedule projections are provided from FY 2010 through FY 2013. Project-specific schedules for active projects will be updated periodically in the SMP. Potentially active projects for years FY 2008 through FY 2009, for which project-specific schedules have been developed, are summarized in Table 5-1 and Figure 5-1. Tentative projections from FY 2010 through FY 2013 are provided in Figure 5-2.

5.1 Team Partnering at Naval Station Norfolk

In October 1996, NAVFAC Mid-Atlantic convened an environmental partnership among the Navy, USEPA, VDEQ, and Navy subcontractors. In addition, the partnership created the RAB to keep members of the community informed of Base IR activities. The partnership is implementing an approach to site remediation referred to as streamlined oversight. The implementation of the streamlined oversight process has promoted a higher degree of communication, understanding, and cooperation among all of the involved groups.

The scheduling assumptions presented below represent an ideal flow of work for sites that are addressed through the conventional cleanup approach. These assumptions do not account for how the streamlined oversight process may affect schedules and potentially affect the sequence of tasks, as the partnership evaluates project progress on an accelerated basis, and expedites the decision-making process. The goal of the streamlined oversight process is to increase the efficiency of the regulatory review processes of implementation, decision-making, reporting, and other environmental regulatory documentation, and to achieve significant savings of time and funding. To date, the streamlined oversight process is estimated to have saved over $4.0 million in remediation costs and 24 months in cleanup schedules in comparison to conventional cleanup approaches.

5.2 Scheduling Assumptions

Assumptions regarding duration of field investigations, laboratory analyses, data validation, document preparation, document review, and RD/RA are discussed below.

5.2.1 Field Investigation and Laboratory Analysis/ Validation

The time required for RI field investigations depends on the size and complexity of the site and the overall scope of the field investigation (i.e., types of field investigation activities, number of sampling rounds, etc.). Generally, field investigations require from two to six months to complete.

A 30-day turnaround time was assumed for laboratory analysis. The standard turnaround time for Naval Facilities Engineering Support Center (NFESC)-approved laboratories under

the current Navy CLEAN Contract is 28 days. A 14-day duration was assumed for validation of laboratory data.

5.2.2 Document Preparation and Document Review

The time required for document preparation under the RI/FS process (see Section 4.1) has been estimated based on prior experience in preparing the various types of documents. A summary of the estimated times required for development of the various types of documents typically prepared during the RI/FS process is presented in Table 5-2. The durations presented in Table 5-2 represent the time required to prepare the initial draft document and do not include time required for review and subsequent revisions of the document.

The time required for document review generally will vary according to the length and complexity of the document, as well as the availability of resources on the part of the reviewing agency. In accordance with the FFA, unless mutually agreed upon by the project management team, all draft primary documents will be subject to a 60-day review and comment period. Exceptions to the time periods required for review and comment on draft documents are identified in the FFA. Prefinal RDs will be subject to a 45-day review and comment period and final RDs will be subject to a 14-day review and comment period. In the event that significant changes are made to the design between the prefinal and final designs, the USEPA may extend the review period by another 14 days. As discussed in the FFA, in some cases the review and comment period on draft RDs and remedial action work plans may need to be expedited for the Navy to satisfy CERCLA requirements.

The following corresponding document review periods were assumed for the purposes of this SMP:

- Working draft: 30-day review by NAVFAC-Mid-Atlantic
- Draft document: 60-day review by Regulatory Agencies
- Working draft final document: 15-day review by NAVFAC-Mid-Atlantic
- Draft final document: 60-day review by Regulatory Agencies

In many cases, the Navy may choose to have concurrent review periods for draft final documents. In those cases, no separate NAVFAC-Mid-Atlantic review would be required for a working draft final document.

For this SMP, it was assumed that 30 days would be required by the consultant to incorporate comments from NAVFAC Mid-Atlantic and the regulatory agency on the draft document and to prepare and submit the draft final document. Also, it was assumed that 15 days would be required by the consultant to incorporate NAVFAC-Mid-Atlantic and regulatory comments on the draft final document and to prepare and submit the final document.

5.2.3 Data Gap Analysis and Supplemental Investigations

The schedules in this SMP reflect the fact that once the results of an investigation have been evaluated and draft (or draft final) reports have been submitted, it is common for data gaps to be identified that will need to be filled before risk management decisions can be made and remedial or removal alternatives can be defined. In fact, it is rare that all pertinent

questions for risk assessment and the nature and extent of contamination are answered in a single phase of investigation. In past SMPs, the schedules for RI/FS projects did not account for multiple phases of investigation and were, therefore, unrealistically short. For the purposes of this SMP, it is assumed that data gap analyses and supplemental investigations will be performed following the review of both the draft and draft final reports.

The steps required for each phase of data gap analysis and supplemental investigations are:

1.	Draft document review by NAVFAC Mid-Atlantic and agencies complete	(see Section 5.2.2)
2.	Data gap analysis	15 days
3.	Work Plan for Supplemental Investigations	15 days
4.	NAVFAC Mid-Atlantic /Agency review of supplemental Work Plan	30 days
5.	Mobilize for Field Investigation	15 days
6.	Supplemental field investigation	15 to 30 days (depending on size of field effort)
7.	Laboratory analysis	30 days
8.	Data validation	15 days
9.	Data evaluation	10 days
10.	Prepare draft final report	(see Section 5.2.2)

Steps 2 to 9 above, are estimated to require approximately six months to complete and are often left out when project schedules are established. Following the draft final document review, it is common for additional data gaps to be identified. This results in Steps 2 to 9 above being repeated and another six months elapsing before the final report can be prepared. The inclusion of data gap analysis and supplemental investigations after both the draft report and the draft final report are estimated to extend project schedules by about a year in comparison to an "ideal" RI/FS where no data gaps are identified after the first phase of investigation is completed.

Through team partnering, the data gap and supplemental investigation phases of a project can be significantly shortened through several steps:

- Environmental data are summarized and presented to the partnering team in tables and graphical form as soon as the data are available.
- As a team, the data are reviewed, data gaps are identified, and additional investigations (if necessary) are scoped during meetings. Although the team develops the scope of additional work based on a consensus, it is understood that additional data gaps may be identified once new results are in.
- The final document deliverable is not prepared and submitted until there is consensus that all significant data gaps have been filled.

5.2.4 Remedial Design/ Remedial Action

The time required for RD/RA depends on the type and complexity of the proposed remedial action. For example, the RD of a groundwater pump-and-treat system generally is much more complex than the RD for a soil removal/offsite disposal remedial action. For example, the groundwater pump-and-treat RD process may require up to one year, whereas the soil removal/offsite disposal RD may require less than three months. In addition, the groundwater pump-and-treat system may operate for a long time (10 to 20 years for remedial action), whereas the soil removal/offsite disposal remedial action may be completed in less than one year. Therefore, schedules for RD/RA activities are only provided for projects where the type of remedial action to be performed is known. The remaining sites are only scheduled up through the ROD phase of the RI/FS process.

5.3 IRP Site Project Schedules

Project-specific schedules for IRP projects that are or potentially will be active in FY 2008 and FY 2009 are presented in Figure 5-1. In addition, tentative site projections are provided for FY 2010 through FY 2013 in Figure 5-2.

The basic strategy used during development of the IRP project schedules was to overlap the RI/FS and RD/RA activities to the maximum extent practicable. By overlapping activities, the overall project schedules are compressed without compromising the interdependencies of the various tasks and documents in the RI/FS process. The amount of overlap of tasks was based on the degree of dependency between the various tasks and documents. Key dependencies and related assumptions are outlined below.

- **RI—**Preparation of the draft RI was assumed to start once all of the analytical data have been received, but prior to data validation. Certain RI tasks can begin before the data are validated; however, in order to prevent duplication of effort, this overlap was assumed to be only two weeks.
- **FS—**Preparation of the draft FS was assumed to begin approximately four months following the start of the RI. Many FS tasks are dependent on the nature and extent of contamination, which is generally defined in the RI report.
- **PRAP—**Preparation of the draft PRAP was assumed to start following receipt of agency comments of the draft final FS, because selection of the proposed remedial action(s) in the PRAP is contingent upon agency approval of the recommended alternative.
- **ROD or DD—**Preparation of the draft ROD was assumed to begin following receipt of agency comments on the draft final PRAP. Since public comments received during the public comment period must be responded to in the ROD, preparation of the final ROD would not begin until closure of the public comment period.

TABLE 5-1
Active Projects for FY 2008 and FY 2009
(October 2007-September 2009)
Naval Station Norfolk

Active Projects for FY 2008 and 2009	Estimated Milestone
Site 1, Site 3, Site 20-Continue meetings for LTM/O&M subgroup to optimize the system and reduce O&M costs as well as accelerating remediation.	FY 2008 and FY 2009
Site 3-AOC 1- Evaluate the effectiveness of accelerated remediation at AOC 1, and determine the next step for the area based on the Close-Out Strategy.	1st Quarter FY 2008
Site 3-AOC 2- Evaluate the effectiveness of accelerated remediation at AOC 2, and determine the next step for the area based on the Close-Out Strategy.	1st Quarter FY 2008
Site 1, Site 3, Site 20- Complete annual LTM report for Camp Allen Landfill, Q-Area, and LP-20.	2nd Quarter FY 2008 and 2nd Quarter FY 2009
Site 2 – Complete LTM groundwater sampling	3rd Quarter FY 2009
Site 6- Submit Groundwater Data Summary Memo for CD Landfill.	2nd Quarter FY 2008
Site 18- Complete Final EE/CA Report	2nd Quarter FY 2008
Site 18- Complete Interim Action	4th Quarter FY 2008
Site 23 – Complete NTCRA construction activities	1st Quarter FY 2008
Site 23 – Complete Final PRAP	2nd Quarter FY 2008
Site 23 – Complete Final ROD	4th Quarter FY 2008
SWMU 14- Complete Final Soil EE/CA	2nd Quarter FY 2008
SWMU 14- Complete Soil Interim Action	4th Quarter FY 2008
Bousch Creek- Complete Upper Reaches Construction Completion Report	3rd Quarter FY 2008
Bousch Creek- Complete Lower Reaches Conceptual Site Model	1st Quarter FY 2008
Complete Five Year Review Report.	4th Quarter FY 2008
Update Site Management Plan in accordance with FFA.	1st Quarter FY 2008 and 1st Quarter FY 2009

TABLE 5-2
Document Preparation Durations
Naval Station Norfolk

Document	Duration (Months) [1]
AOC Close-Out Document	1
SSP Work Plan	1
SSP Report	1-2
Preliminary Assessment/Site Inspection	2
Engineering Evaluation/Cost Analysis	1-2
RI/FS Work Plans	2
Remedial Investigation Report	3-4
Supplemental Investigation Work Plans	2
Supplemental Investigation Report	3-4
Feasibility Study	3-4
Proposed Plan	2
Record of Decision	2
Preliminary/Conceptual Remedial Design	2
Pre-Final Remedial Design	2
Final Design	1-2
Treatability Study Work Plan	2
Treatability Study Report	1-2
Removal Action Work Plan	2
Removal Action Completion Report	1-2

[1] Durations represent estimated time required to complete Draft Documents.

Figure 5-1
Project-Specific Schedules
FY2008 and FY2009
Naval Station Norfolk

Site Description	Oct 07	Nov 07	Dec 07	Jan 08	Feb 08	Mar 08	Apr 08	May 08	Jun 08	Jul 08	Aug 08	Sep 08	Oct 08	Nov 08	Dec 08	Jan 09	Feb 09	Mar 09	Apr 09	May 09	Jun 09	Jul 09	Aug 09	Sep 09
Site 1- Camp Allen Landfill		Draft 2007 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report	LTM Groundwater Sampling, Water Level Measurements	Laboratory Analysis	Data Validation				Water Level Measurements		Draft 2008 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report	LTM Groundwater Sampling, Water Level Measurements	Laboratory Analysis	Data Validation				Water Level Measurements
Site 2- NM Slag Pile		Draft 2007 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report																LTM Groundwater Sampling	Laboratory Analysis	Data Validation	
Site 3- Q Area Drum Storage Yard		Draft 2007 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report LTM Groundwater Sampling	Laboratory Analysis	Data Validation				LTM Groundwater Sampling	Laboratory Analysis	Data Validation	Draft 2008 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report LTM Groundwater Sampling	Laboratory Analysis	Data Validation				LTM Groundwater Sampling	Laboratory Analysis
Site 6- CD Landfill			LTM Groundwater Sampling	Laboratory Analysis	Groundwater Monitoring Data Summary Report	Groundwater Monitoring Data Summary Review LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling	Laboratory Analysis		LTM Groundwater Sampling
Site 18		Submit Draft EE/CA Draft EE/CA Report Review	Draft EE/CA Report Review	Submit Draft Final EE/CA and Public Notice Public Draft Final Review	Public Review of Draft Final EE/CA Submit Draft Action Memorandum Client Review of Action Memorandum	Responsiveness Summary Final EE/CA Final Action Memorandum		Submit Draft RA Work Plan Regulatory Review of RA Work Plan	Regulatory Review of RA Work Plan	Construction (Injections)	Final Work Plan		Performance Monitoring			Performance Monitoring			Performance Monitoring			Performance Monitoring	
Site 20- LP 20 Site Long Term Monitoring		Draft 2007 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report LTM Groundwater Sampling	Laboratory Analysis	Data Validation							Draft 2008 Annual Long-Term Monitoring Report	Draft LTM Report Review	Draft LTM Report Review	Final 2008 Annual Long-Term Monitoring Report LTM Groundwater Sampling	Laboratory Analysis	Data Validation					
Site 22- Camp Allen Salvage Yard																								
Site 23 - LP-20 Plating Shop	Draft Construction Completion Report	Review of Draft Construction Completion Report Draft Site 23 PRAP	Final Construction Completion Report Review of Draft Final Site 23 PRAP	Draft Final Site 23 PRAP	Draft Final Site 23 PRAP Review and Public Comment	Final Site 23 PRAP Draft Site 23 ROD	Draft Final Site 23 ROD Review	Draft Final Site 23 ROD	Draft Final Site 23 ROD Review and Public Comment	Final Site 23 ROD Draft Site 23 Remedial Design	Draft Site 23 Remedial Design Review	Draft Final Site 23 Remedial Design	Draft Final Site 23 Remedial Design Review	Final Site 23 Remedial Design										
SWMU 14 Q-50 Accumulation Area	Draft SWMU 14 Soil EE/CA Draft SWMU 14 Soil EE/CA Review Conduct Topo Survey	Draft SWMU 14 Soil EE/CA Review	Draft Final SWMU 14 Soil EE/CA Draft Action Memorandum	Review of Draft Final SWMU 14 Soil EE/CA Review Draft Action Memorandum	Final SWMU 14 Soil EE/CA Submit Final Action Memorandum Draft Focused FS	Submit Draft Remedial Action Work Plan Review Draft Focused FS	Review Draft Remedial Action Work Plan Review Draft Focused FS	Review Remedial Action Draft Work Plan Draft Final Focused FS Review Draft Final Focused FS	Submit Final Remedial Action Work Plan Begin SWMU 14 Construction Review Draft Final Focused FS Final Focused FS	Draft PRAP	Draft PRAP Review SWMU 14 Construction	Draft PRAP Review SWMU 14 Construction Complete	Draft Final PRAP Review	Review of Draft Final PRAP Final PRAP Draft Construction Completion Report	Regulatory Review of CCR	Final CCR Draft ROD	Review of Draft ROD	Review of Draft ROD	Draft Final ROD Review of Draft Final ROD	Review of Draft Final ROD Final ROD	Draft Remedial Design	Review Draft Remedial Design Draft Final Remedial Design	Review Draft Final Remedial Design	Final Remedial Design
Bousch Creek - Upper Reaches	Draft Bousch Creek Remedial Action Work Plan Review	Final Bousch Creek Remedial Action Work Plan Implement Remedial Action		Draft Construction Completion Report	Draft Bousch Creek CCR Review	Final Construction Completion Report																		
Bousch Creek - Lower Reaches			Draft CSM	Draft CSM review	Final CSM																			
Basewide	Draft FY 2008 SMP	Draft FY 2008 SMP review	Draft FY 2008 SMP review	Final FY 2008 SMP			Draft Five Year Review Report	Draft Five Year Review Report review	Draft Five Year Review Report review		Final Five Year Review Report													Draft FY 2009 SMP

Figure 5-2
Project Projected Schedules
FY2010 through FY2013

Naval Station Norfolk

Site Description	FY 2010				FY 2011				FY 2012			
	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Site 1- Camp Allen Landfill	2010 LTM Report	LTM sampling			2011 LTM Report	LTM sampling			2012 LTM Report	LTM sampling		
Site 2- NM Slag Pile												
Site 3- Q Area Drum Storage Yard	2010 LTM Report	LTM sampling			2011 LTM Report	LTM sampling			2012 LTM Report	LTM sampling		
Site 6- CD Landfill	LTM Sampling	Groundwater Monitoring Report	LTM sampling		LTM Sampling	Groundwater Monitoring Report	LTM sampling					
Site 18	Draft Construction Completion Report and Review	Final Construction Completion Report Draft PRAP	Draft Final and Final PRAP	Draft ROD	Draft Final and Final ROD	LUC Remedial Design						
Site 20- LP 20 Site Long Term Monitoring	2010 LTM Report	LTM sampling			2011 LTM Report	LTM sampling			2012 LTM Report	LTM sampling		
Site 22- Camp Allen Salvage Yard												
Site 23 - LP-20 Plating Shop												
SWMU 14 Q-50 Accumulation Area												
Bousch Creek-Upper Reaches												
Bousch Creek-Lower Reaches												
Basewide	FY 2010 SMP				FY 2011 SMP				FY 2012 SMP			
Five-Year Review												

SECTION 6

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